REALIZING CONCURRENT ENGINEERING IN PRODUCT DEVELOPMENT: A SURVEY ON TWO WHEELER AUTO INDUSTRY

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ABSTRACT

Introducing a new product with high level expectation of customer satisfaction is an intricate and immense challenge to the companies in present day aggressive business environment. Concurrent Engineering (CE) has a great deal of importance in design and development of new products in automobile industry and is posing an intense challenge to manufacturing firms in the wake of globalization. Success of concurrent engineering demands that key areas of product design and development of an organization are kept in spotlight concomitantly. The aim of the paper is to present survey results of major factors influencing the new product design and development in selected two wheeler auto industries. The survey presents its evaluation based on the data analysis using statistical tool with the help of primary data collected through a pre-tested questionnaire. The findings reveal that the application of concurrent engineering techniques, involvement of outsiders (customers, suppliers), and coordination of internal groups (design, manufacturing) etc., are prioritized by awarding first, second and third ranks further two wheeler manufacturing companies are realizing maximum benefits with the implementation of the concurrent engineering in new product design and development. The research also recommends that companies must focus on fragile areas of design and development, identify the appropriate revolutionary technologies for proto-typing and thus increase cost savings and reduce time to market, enhance the productivity ultimately satisfying the customer needs.

Keywords: Concurrent Engineering, New Product Development, Productivity, Technologies

I INTRODUCTION

The study of concurrent engineering (CE) and its implementation has been the greatest themes in the engineering sciences. Many disciplines have developed theoretical literature and empirical findings about the origin, expansion, transformation, decay, and refuse of the system. Concurrent engineering is indisputably the wave of the future for new product development for all companies regardless of their size, sophistication, or product portfolio. In order to be competitive, firms must alter their product and process development cycle to be able to complete diverse tasks concurrently. This new process will benefit the company, although it will require a large amount of refinement in its implementation. This is because concurrent engineering is a process that must be

reviewed and regulated for continuous improvements of engineering and business operations. In today's global business world, the firms must be able to act and react quickly and responsively to the changing market needs. Moreover, they must be able to significantly reduce their time to market and adapt to the shifting business environments, because of product's shorter life period. Therefore, concurrent engineering has emerged as way of bringing swift solutions to product design and development process.

II DEFINITION

According to Nielsen (2003) [1], concurrent engineering is the simultaneous consideration of more than one aspect of a system during its design phase. Concurrent engineering is a system of practices that provides the environment for design engineering and production departments work together, which enhances productivity and leads to high-class designs. Concurrent engineering is defined as "a business strategy which replaces the traditional product development process with one in which tasks is done in parallel and there is an early consideration for every aspect of a product's development process". This strategy focuses on the optimization and distribution of a firm's resources in the design and development process to ensure effective and efficient product development process.

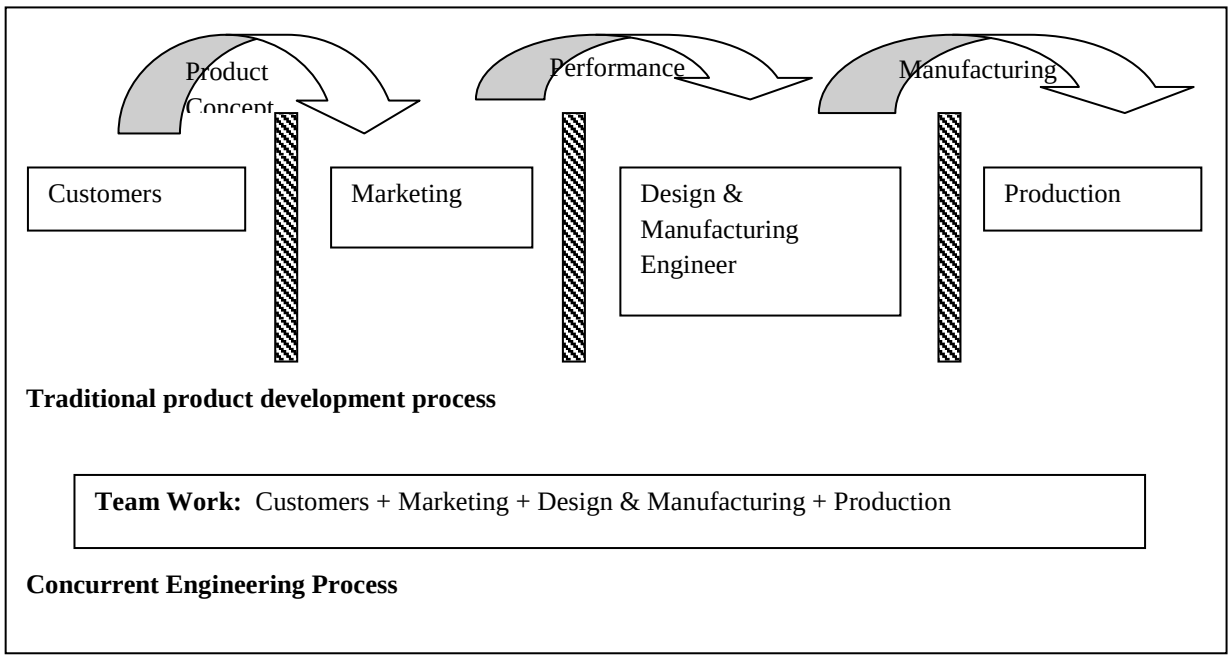

Figure 1: Traditional Product Development Process Vs Concurrent Engineering Process

III LITERATURE SURVEY

Scott E. Dahne of Westinghouse Electric Corporation (1992) [2] in his paper "A Concurrent Engineering Model of the Design and Manufacturing Process for Electronic Assemblies" writes that the global marketplace for manufacturing of electronics has become increasingly competitive and promises to become even more so in the next decade. In order to remain competitive, manufacturers must utilize the abundant resources of the information age along with the philosophy embodied by concurrent engineering to reduce costs and improve efficiency in all aspects of their enterprise.

Harvey Maylor in his paper "Concurrent New Product Development: An Empirical Assessment" (1997) [3] has discussed operationalization of concurrent new product development in U.K. firms. He concludes that use of new tools like concurrent engineering helps the firms to achieve effective satisfaction of customer needs and less time to penetrate the market. But the limitations of the use of these techniques needs changes in organizational set up, creates adverse effects.

Ray Gosling in his study "The Reality of Concurrent New Product Development" (1998) [4] have concluded that many companies are going for concurrent design and redesign of new products by using the new techniques which have worked best in industries. The success of many industries lies in using certain technologies which are in the domain of product development manager. They have also shown that these technologies are better than the high levels of usage of technology. Finally conclude that this type of using workable technologies to develop product has significant effect on firm's investment policy. The limitations are the firm has to train the management in project management and training.

J.A. Harding, A.R. Omar, K. Popplewell in their paper "Applications of QFD within a concurrent engineering environment" (1999) [5] writes that the companies which are willing to bring their products quickly to market, concurrent engineering techniques will help them. The companies must maintain quality standards desired by the consumer, but consumer is not available to him during design stage hence the design should concentrate to satisfy functional aspects than trying to satisfy individual customers. They have discussed the method of getting concurrent engineering environment and quality function deployment techniques to provide an extended design team with valuable, shared information throughout the design process.

Hojjat Adeli, in his paper "Competitive edge and environmentally- conscious design through concurrent engineering" (1999) [6] has advocated that Concurrent engineering or simultaneous engineering helps to companies can manufacture and market the product in shortest possible time and with minimum cost. He also concludes that the technological advances will help to expedite the process. Martin Jarvis in his paper "Concurrent engineering" (1999) [7] has discussed how the concept of concurrent engineering shortens the life cycle time of product development and design stage and getting it to the market and also highlighted factors influencing successful approach of concurrent engineering.

In the literature survey, Scott .E.Dahne, Harvey Maylor, Ray Gosling, J.A. Harding, Hojjat Adeli, Martin Jarvis have clearly discussed in their articles that the main way to success in achieving shortest time in product development and design time is *the adoption of Concurrent Engineering Techniques*. In their attempt, to meet the competition in the market, when they introduce the new / improved product many companies have realized that concurrent engineering technique is the best way to reach the market early and to capture the market.

IV THE SCENARIO

The managers of automobile sector are of the opinion that the complexity of the product and the economy of the country, the legal barriers, and road conditions are some of the reasons for drop in product introduction time. In addition of the above factors, the technology level and the work force co-operation also act as barriers. In spite

of all the above barriers the industry is trying to develop the product and introduce in the market at the earliest possible.

V PURPOSE OF THE STUDY

The objective of the research study is to identify and establish the impact of different parameters that are influencing the product design and development in two wheeler automobile industries.

VI METHODOLOGY

The evaluation of the study is based on data analysis (primary data) collected using statistical analysis technique. The primary data was collected through a well-structure questionnaire from the respondents of design, production and marketing groups of two wheeler manufacturing companies. The questionnaire was sent to the respondents of 3 automobile companies and the usable response rate was 53% (see the Table 1).

Table 1: Response Rating of the Survey

	Number of Organizations		**Response Ratio (in percentage)**
	Questionnaire Sent to	Response Received	
Two Wheeler Industry Automobile manufacturers	03	03	100%
No. of Respondents	243	129	53%

Source: Information given by respective Industries departments.

A request is made to the managers of the companies who have responded for the questionnaire to rank the selected parameters and the weighted scores were calculated accordingly by allocating four points to the first rank, three, two, one to the second, third and fourth respectively. The points each parameter received are totalled to obtain the weighted score for that parameter. The weighted scores received by each of them and their ranking are shown in the table2.

Table 2: Weighted Scores and Ranking of Parameters Having Influence on Product Development and Design

S. No.	**Parameters**	**Ranking**				**Weighted Scores**	**Ranks**
		R_4	R_3	R_2	R_1		
		I (4)	II (3)	III (2)	IV (1)		
1	Application of concurrent engineering techniques.	10	01	01	-	45	1
2	Involvement of outsiders – customers, suppliers etc.,	08	02	02	-	42	2
3	Coordination of internal groups – design, Manufacturing etc.	07	03	02	-	41	3
4	Smoothening of organizational barriers.	07	03	01	01	40	4

5	To entertain external agencies like research organizations.	05	05	01	01	38	5
6	Implementation of collaboration /partnership of managements	05	04	02	01	37	6
	Total					243	

Source: Field Survey.

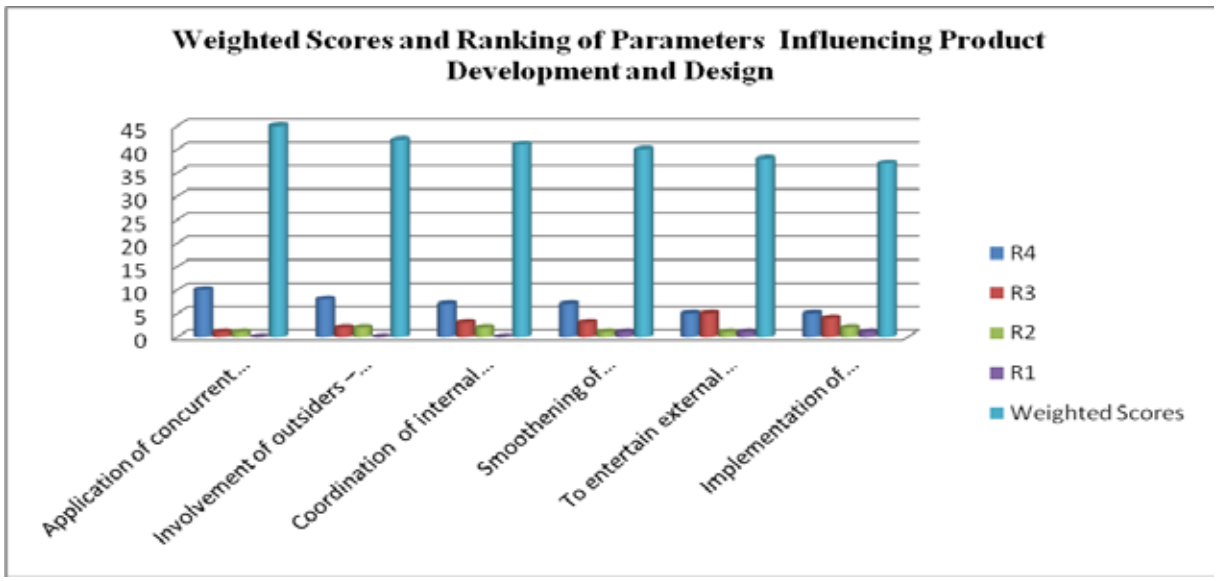

Figure2: Bar chart Showing Weighted Scores and Ranking of Parameters Having Influence on Product Development and Design

VII INTERPRETATION

The scores and the ranking shown in the table2 is very significant and interesting and advocates the application of concurrent engineering techniques is the important parameter in reducing the product development and design time and enables the company to release the product in the market early. Involvement of customers and suppliers i.e., the participation of outsiders in product development and design ranked 2nd by scoring 42 out of total 243 scores. Co - ordination of internal groups such as design, manufacturing etc., was ranked 3rd by the respondents which has score of 41 out of 243 scores. Smoothening organizational barriers got 4th rank with a score of 40 out of 243 scores. Entertaining of external agencies got 5th rank with a score of 38 and implementation of collaboration / partnership of managements got 6th rank with a score of 37 out of 243 scores.

VIII FINDINGS

In ranking the parameters, the industrial managers have opted 1st rank for the use of *concurrent engineering techniques* to show that this is very important parameter in reducing the new / improved product development and design time. Further managers have shown different rankings depending on the nature of their business and expertise for the parameters - *involvement of outsiders such as customers and suppliers in product development*

and design time, coordination of internal groups such as design and manufacturing departments, smoothening of organizational barriers, to entertain external agencies like research organizations, consultants. All managers have ranked the parameter expressing the *collaboration / partnership of managements* to reach the market early as the 6th one.

IX CONCLUSIONS

The above said factors are influencing the reduction of new product introduction and development time at local market (i.e., NPID). However, globalization of the world market means that global manufacturing, collaboration is a realign and, the industries must consider global NPID (i.e., GNPID). The producers of products have to strive hard for survival because of growing competition in the market. Also the customer's preferences are changing day by day as the purchasing power of the individuals is growing due to increased level of earnings. In such a situation the managers of product development and design activities have to search for newer ways of cutting the design and development time so as to reach the market early and to grab the market. Concurrent engineering has shown a very positive impact on new product design, development and introduction in two wheeler automobile companies. Though companies are implementing concurrent engineering and realizing maximum benefits, they need to focus their attention in identifying the appropriate revolutionary technologies for proto-typing and thus increase cost savings and reduce time to market eventually satisfying the customer needs.

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WEB IMAGE SEARCH ENGINE USING QUERY SPECIFIC SEMANTIC SIGNATURES

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ABSTRACT

Image search engine, as an effective way to provide matching of images in a semantic space which used attributes or reference classes closely related to the semantic meanings of images as basis. Given a query keyword, a pool of images is first retrieved based on textual information. By asking the user to select a query image from the pool, the remaining images are re-ranked based on their visual similarities with the query image. In this paper, we propose a image search framework, which automatically offline learns different semantic spaces for different query keywords. The visual features of images are projected into their related semantic spaces to get semantic signatures. The proposed query-specific semantic signatures significantly improve both the accuracy and efficiency of image re-ranking.

Keywords : Image Search, Semantic Signatures, Image Re–Ranking, Keyword Expansion, Semantic Space

I INTRODUCTION

Web - image search engines mostly use keywords as queries and rely on surrounding text to search images. They suffer from the ambiguity of query keywords, because it is hard for users to accurately describe the visual content of target images only using keywords. For example, using “apple” as a query keyword, the retrieved images belong to different categories, such as “red apple”,”apple logo”, and “apple laptop”. In order to solve the ambiguity, content-based image retrieval[9] is widely used. It requires users to select multiple relevant and irrelevant image examples, from which visual similarity metrics are learned through online training. Images are re-ranked based on the learned visual similarities.

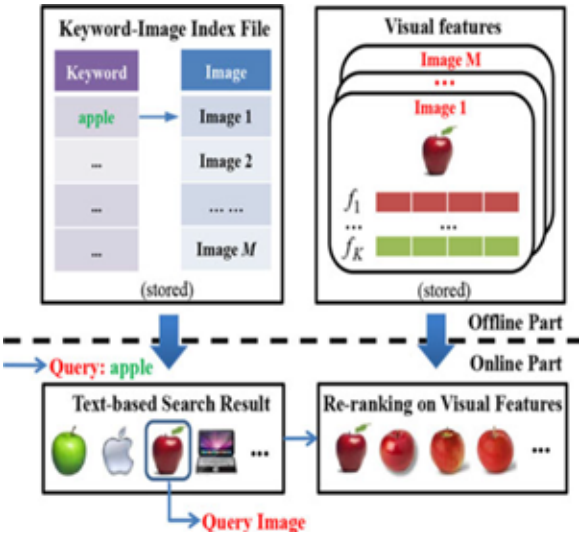

Fig. 1: The conventional image re – ranking framework.

In this paper, a novel framework is proposed for web image re-ranking. Instead of manually defining a universal concept dictionary, it learns different semantic spaces for different query keywords individually and automatically.

II. EXISTING SYSTEM

In the current commercial search engines, user given a query keyword a pool of images are first retrieved based on textual information. They suffer from the ambiguity of query keywords, because it is hard for users to accurately describe the visual contents of target images only using keywords. Large amounts of junk images which are irrelevant to the given keyword – based queries.

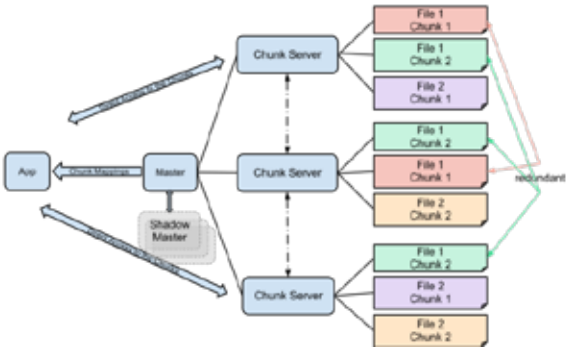

Fig. 2: System Design

III. PROPOSED SYSTEM

Here, we have proposed a query – specific semantic spaces can more accurately provide the images to be re – ranked. For example, if the query keyword is “apple,” the concepts of “mountain” and “Paris” are irrelevant and should be excluded. Instead, the concepts of “computer” and “fruit” will be used as dimensions to learn the semantic space related to “apple.” The query-specific semantic spaces can more accurately model the images to be re-ranked, Since they have excluded other potentially unlimited number if unrelevant images, It is also

effective, where it is crucial to reduce the semantic gap when computing the similarities of images. The proposed system which refined image search with relative attribute.

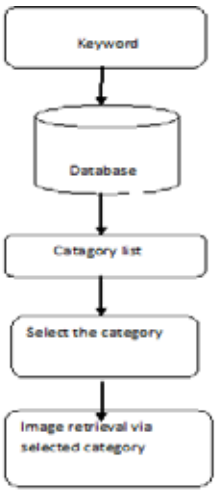

Fig. 3: System Design

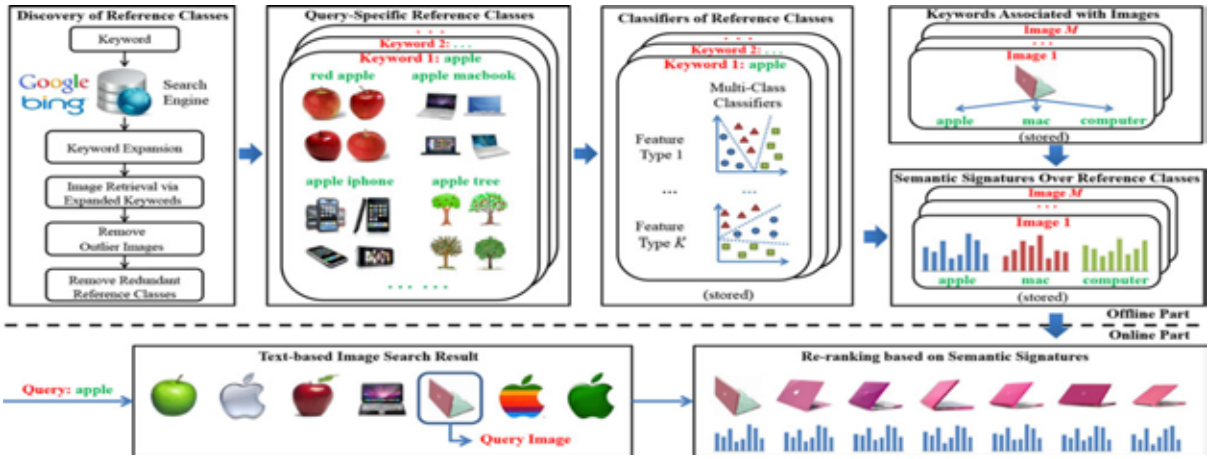

Fig. 4: Web Image Search Engine Using Query Specific Semantic Signatures

At the offline stage, the reference classes related to query keywords are automatically discovered. For each query keyword, its reference classes forms the basis of its semantic space. The semantic signature of an image is extracted by computing the similarities between the image and the reference classes of the query keyword.

IV.EXPERIMENTALS RESULTS

The images for testing the performance of re-ranking and the training images of reference classes can be collected at different time (since the update of reference classes may be delayed) and from different search engines. Given a query keyword, 1,000 images are retrieved from the whole web using a search engine. As summarized in Table 1, we create three data sets to evaluate the performance of our approach in different scenarios. In data set I, 120; 000 testing images for re-ranking were collected from the Bing Image Search with 120 query keywords in July 2010. These query keywords cover diverse topics including animals, plants, food,

places, people, events, objects, and scenes, etc. The training images of reference classes were also collected from the Bing Image Search around the same time. Data set II uses the same testing images as in data set I. However, its training images of reference classes were collected from the Google Image Search also in July 2010. In data set III, both testing and training images were collected from the Bing Image Searchbut at different time. All the testing images for re-ranking are manually labeled, while the images of reference classes, whose number is much larger, are not labeled.

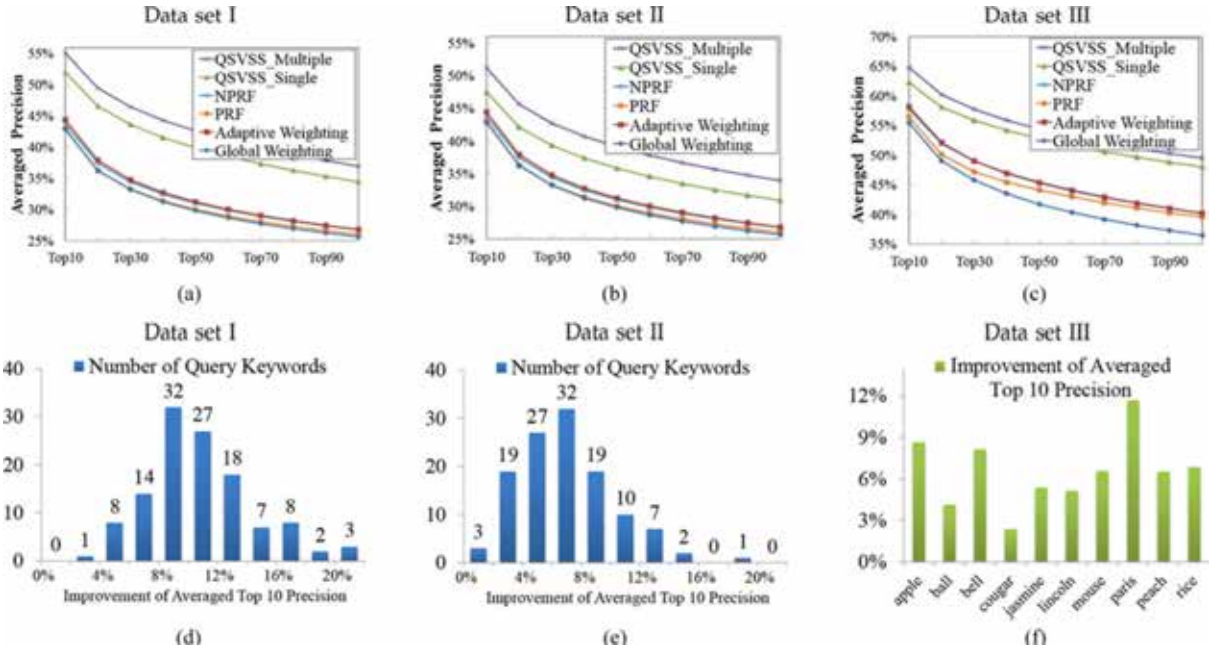

Fig. 5. (a)-(c) Averaged top m precisions on data sets I, II, III. (d) and (e) Histograms of improvements of averaged top 10 precisions on data sets I and II by comparing QSVSS Multiple with Adaptive Weighting. (f) Improvements of averaged top 10 precisions on the 10 query keywords on data set III by comparing QSVSS Multiple with Adaptive Weighting.

V. CONCLUSION

We propose a image framework, which learns query – specific semantic spaces to significantly improve the effectiveness and efficiency of online image re – ranking. The visual features of images are projected into their related semantic spaces automatically learned through keyword expansions offline.

VI. ACKNOWLEDGEMENTS

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QUALITATIVE COMPARISON OF ACTIVATION OF ABS PLASTIC COMPONENT FOR ELECTROPLATING

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ABSTRACT

Converting non-conductive ABS plastic into conductive ABS plastic .The key objective here is to draw out two methods of transforming Acrylonitrile Butadiene Styrene(non-conductive) plastic part into conductive plastic, first being by Brass conductive paint and second by chemical method to create a conducting surface for ensuing copper and nickel deposition.. ABS plastic is basically amorphous and hygroscopic material which is non-conductive hence chemical method and conductive paint method has been adopted to make them conductive. The electroplating procedure and conductive paint method both are presented in this research and on the basis of CASS test (Copper accelerative salt spray test), Temperature cycle test, and Plating thickness inspection with destructive test meter. We will conclude the comparison result and this study will open up better routes of plating on Plastics. To top it up, in my opinion it can be used for the betterment for automobile industry

Keywords: ABS, Electroplating, Chemical Method, Conductive Paint, CASS Test, Temperature Cycle Test, PLT Thickness Test

I. INTRODUCTION

Manufacturing industry is an area where time, efficiency, accuracy and quality are major driving forces behind innovation and research. Electroplating plays a vital role in our day to day lives. Electroplating effects and enhances our lifestyle in many ways. In addition, it is an extremely important and versatile process. It mainly used to produce components for decorative purposes and sometimes for electronic industries. The technical courses presented in colleges and universities merely present information on this subject. Nevertheless electroplating is a unique metal fabrication technique and copper & nickel are the principal metals in this industry. It finds a great usage in the automobile and aerospace industries.

A rapid use of electroplating in plastic industry has given birth to a new era in the technology of manufacturing industry and making better products with better quality and good accuracy. Electroplating is an electrochemical process where metal ions are transferred from a solution and are deposited as a thin layer onto surface of a cathode. The heart of the electroplating process is the electrolytic cell. To achieve uniform coatings during electroplating of metals on plastics deposition of metals such as copper, nickel an electrolytic bath is involved. In the electrolytic cell a current is passed through a bath containing electrolyte, the anode, and the cathode. [**1]**

The major expansion of electroplating has been brought in the field of non-metallic surfaces, such as plastics. A large number of consumer goods are coated by this method to create durable and attractive surfaces. Electroplating has been described in different ways but ASTM 2003 describes it simply the process of plating a metallic thin layer of metal by electrolysis. In electroplating when a Direct current is passed through an electrolyte, metal will be deposited on the cathode and equivalent amount of metal will be eaten away from the anode, thus composition of the electrolyte remains unchanged. This is the basic principle on which electroplating is based. Electroplating has been employed for giving shiny, decorative or protective finishes to variety of articles which we use in our day to day life**.[2]**

II. TYPES OF ELECTROPLATING

Automobile aerospace machinery widely use Electroplating products. The two widely used methods for electroplating on plastics are chemical method and conductive paint method. The chemical method involves coursing the surface to allow metals to adhere so that electroplating can be done over the surface of Plastic. The dualistic method is to smear conductive paint over the metal and finally electroplate it.**[3]**

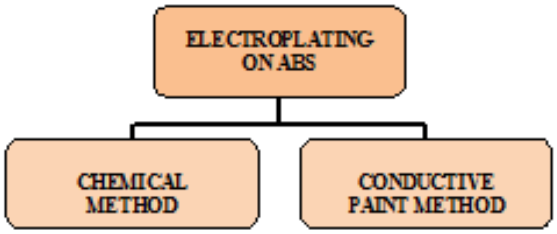

Fig.1 Types of Electroplating

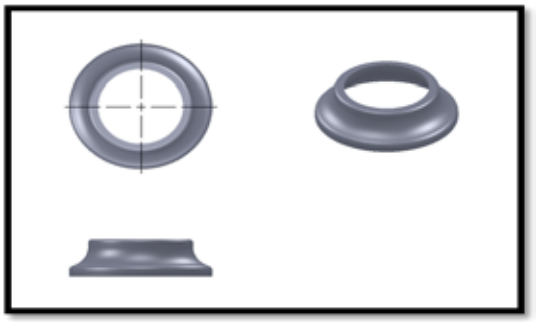

Fig.2. CAD of Sample Part

Rapid advances in manufacturing technology have resulted in conductive paint technology. There are many conductive paints (like silver, nickel, brass, copper, etc) that are used in industries according to their specified use. The most significant conductive paints which are used frequently in industries are Direct Brass conductive paint and direct copper conductive paint. Brass/ Copper Conductive Paint are an inexpensive alternative to our highly conductive Silvaspray™ silver conductive paint. These high solids paints are formulated to provide a uniform, high quality conductive film when sprayed or painted on the surface of ABS.**[4]**

For chemical method , Prof. H N Zhang experimented that the 6-(3-triethoxysilylpropyl) amino-1, 3, 5-triazine-2, 4-dithiol monosodium (TES) was used to fabricate self-assembled film on corona pre-treated acrylonitrile-butadiene-styrene (ABS) resin surface.It was designed to ensure good adhesion to the surface. The self-assembled film modified ABS resin was treated by electroless copper plating. In his paper SEM results indicated that porous morphology appeared on the ABS resin surface modified by TES self-assembled film, and the surface roughness also increased. The adhesion test showed that the adhesion property between ABS resin and copper was excellent. The surface of electroless copper film had high brightness under the optimal condition of 1min corona-discharge, 30min self-assembly and 10min electroless copper plating **[5].**

Rapid advances in manufacturing technology have resulted in new activation technology for ABS plastics which is conductive paint technology. Traditionally Conductive paints have been used to coat plastics to achieve EMI shielding. It is a new and easy method of converting non-conductive plastic surfaces into conductive by coating

with copper based conductive paints to create a conducting surface for a subsequent copper deposition and thus for electroplating them**[6].**

The electroplating of ABS chemical concentration, current density, and temperature also plays vital role. It is to be noted that any slight variation in chemical concentration and current density would lead to improper plating or uneven plating. Burning of part occurs when excessive current density is applied on the part and this also increased the temperature of the electrolytic bath. Although the operating temperature range in a nickel bath can be quite wide, (from 54 to 76^{o}C), the most recommended temperature is between 60 and 70^{o}C. **[7]**

III. EXPERIMENTAL DETAILS

In this paper Acrylonitrile Butadiene Styrene (non-conductive) plastic part was fabricated by Rapid Prototyping using fused deposition Modling. A CAD model of the desired component was made on Pro-e software and it was converted in to STL format for fabrication of the work piece via FDM in 3D printer. The Acrylonitrile Butadiene Styrene (non-conductive) plastic part is fabricated using 3D printer. The underlying technique used in 3D printer is additive manufacturing. 3D printer fabricates three dimensional work pieces from STL digital file, which is achieved by placing continual layers over the object till whole of it is shaped. For the present work, work piece manufactured using FDM as rapid prototyping technique. The various parameters of work piece are: Volume = 9693.17 mm^{3,} Mass = 9.69 gm and Surface area = 10369.62 mm^{2} . Further, in this paper chemical method and paint method are discussed in detail.

3.1 Chemical Method Of Electroplating Of Abs Activation

In electroplating of plastic by Chemicals, firstly course the surface to allow metals to adhere so that electroplating can be done over the surface of Plastic. This process is bit complicated, it includes a long chain of applications of chemicals such as zinc plate 452, hydrochloric+442, chromic acid, sulphuric acid etc. Plastic sample is treated several times with different chemicals so that non-conductive plastic part can become a conductive plastic so that electroplating can be performed.

Surface pre-treatment by chemical is very important in the case of preparations for electroplating by chemical method. Surface Preparation is designed to ensure good adhesion to the surface. In our surface treatment we cleaned the ABS specimen surface, usually this includes employing of hot soap degreasing, solvents, acid cleaners like H_2SO_4 dip, abrasive materials and water. Hot soap degreasing and H_2SO4 dip will do modification of surface. That includes change in surface attribute and after that rinsed it with tap water or washed off with water. Now our ABS part is ready for Etching process. For etching of plastic part rinsed it with water several times after each step to clear away the dust and dirt from its surface.The Etch is a solution of chromic acid and sulphuric acid at elevated temperatures. Typical concentrations range from 300-500 g/l of chromic acid and 300-500 g/l of sulphuric acid with small amounts of wetting agents to allow the viscous solution to enter small grooves and depressions. Temperature ranges are usually 65° - 75 ^{o}C (149 – 167 ^{o}F)**[8].**

Drop the part in a chrome-sulphur bath. The acid will pit, or etch, the surface, so that metal can adhere. This process is also termed as etching in which by chemical mode butadiene is removed from Acrylonitrile Butadiene Styrene plastic creating microscopic gaps in the part. These microscopic gaps act as the site for the deposition of electro-pla-table materials. After etching various rigorous chemical steps will involved in activation (like pre-

activators, activators, neutralizer etc.) process of ABS (steps explained in fig 2). And when the ABS part is made active or made conductive by the activation processes the ABS part is ready for electroplating. **[9]**

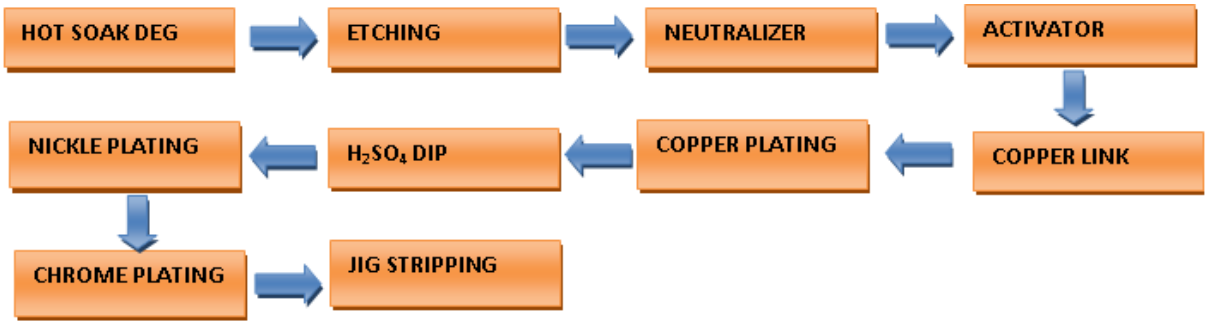

Fig.3. Chemical activation of ABS

3.2 Conductive Paint Method for ABS Activation

Conductive paint is a very simple method of making ABS part conductive. Conductive Paints are non-toxic water based, and water soluble, electrically conductive paint. Electric or conductive Paint adheres to a wide variety of substrates and is easily removed with water and it can be over painted with any material compatible with a water-based paint. Conductive paint is a unique material that is electrically conductive material made up of a conductive powder suspended in a binding fluid. It works with low voltage DC power sources and most important it makes the ABS part conductive so that ABS part can electroplate. In order to prepare a cleansed sample a 300-grid sand paper is scoured on the surface and washed off with water. Scouring provides a coarse surface for the adhesion of the conductive paint. The cleansed sample is then painted with direct brass conductive paint manufactured by SUGANDH CORPORATION, Mumbai. Applied two coatings of the paint on the ABS sample and leaved it for 20 min to dry.

Fig.4. Conductive Paint Method for ABS Activation

IV. OBSERVATION AND DISCUSSION

After performing experiment, we have successfully determined our methodology to electroplate ABS parts. Surface finished and thickness was better in case of chemical method in comparison to paint method. We achieved maximum thickness (in electroplating) of copper 42.9 Micron, Nickel 45.3 microns and chrome .41 microns. We also observed, since the samples were transferred from one solution to another, pollution of electrolyte was also observed.

Fig.5. Brightness Comparison of

Fig.6. Dullness and roughness in Conductive Paint sample

(a) Conductive paint part (b)chemically active part

As a result of the pollution, the electrolyte loses its properties and causes decrease in coating thickness. The process of electroplating not only improves the aesthetics but also changes the chemical and mechanical properties of the work piece. The deposition of the nickel layer improves the strength and chrome layers improve the corrosion resistance property of the sample. Now we will observe and discuss CASS test (Copper accelerative salt spray test), Temperature cycle test, Adhesion evaluation and plating thickness inspection with destructive test meter.

For CASS test (Copper accelerative salt spray test), samples were left in CASS machine where specimens were tested for 48 hours in different environment maintained in the machine. In both chemical method and paint method no rust was observed but there was some change in brightness in paint sample. Results of CASS Test are mentioned in Table 1.

Table.1. Copper accelerative salt spray test

Qty	Duration of Test	Observations Of Chemical Method	Observation by Paint Method
Two samples tested	48 hours	1) No rust observed 2) Brightness in sample	1) No rust observed 2) Dullness in sample

In Temperature cycle test, Sample's quality was good in chemical method and Sample's quality was fine in case

of paint. We kept specimen continuously for 1 hour at 80° C and then after one hour we kept specien for 30 min at 28° C and then at -30 °C for 1 hour and again at 28 °C for 30 min..Result of temperature cycle test is mentioned in Table 2.

Table.2. Temperature cycle test (3 Cycles)

QTY	Specification	Observations Of Chemical Method	Observation by Paint Method
Two sample Tested	80° C for 1 hour	1) Surface Finish is good. 2) Quality of brightness is good.	1) Surface Finish is Fine. 2) oxidation observed 3) Yellowish dullness is
	28° C for 0.5 hours		
	-30° C for 1 hour		
	28° Cfor 0.5 hours		

Thickness is very important parameter for electroplating. In plating thickness inspection with destructive test meter we observed the thickness of copper, nickel and chrome shown in Table.3. In thickness inspection with destructive test meter we used SN9, SN5 and SN2 for Cu, Ni and Cr .Thickness of copper, nickel and chrome shown in Table 3.Variation of PH was also observed in chrome bath and nickel bath. PH of 4.5 was observed in the nickel bath and that has produced uneven plating. In chemical method max thickness of copper plating was observed 42.9 microns when part was left in copper bath for 20 minutes at 2.5 Ampere current, Nickel value was observed 45.3 microns when part was left in nickel bath for 20 minutes at 2.5 Ampere current and chrome value was .41 microns when part was left in chrome bath for 60 seconds at 100 Ampere current. Results of thickness test are mentioned in table 3.

Table.3. PLT thickness test with destructive test meter

QTY	Specifications	Observations Of Chemical Method (Microns)		Observation by Paint Method (Microns)	
Two sample Tested	SN9 for Copper	39.7	42.9	27.4	29.3
	SN5 for Nickel	43.9	45.3	36.7	34.9
	SN2 for chrome	0.39	0.41	0.31	0.34

V. CONCLUSION

Electroplating of ABS was governed by chemical method and brass conductive paint method. Brass conductive paint as coated onto ABS plastic to create base layer for Cu surfaces onto which Nickel readily deposited for giving strength to the sample piece and for corrosion resistance chrome layer is electroplated through electroplating procedure, results are concluded on the basis of 3 tests on the electroplated sample. (Results are shown in table 1, table 2 & in table 3).

For CASS test (Copper accelerative salt spray test), there was some change in brightness in paint sample. In paint method, painted the part by brush and this has caused improper layering of conductive paint on ABS part. Improper layering will cause improper electroplating and roughness which can cause change in brightness where as in chemical method ABS part was properly activated so plating was good**.** Although the operating temperature range in a copper bath was maintained at 26 ^{o}C to 30 ^{o}C but temperature in nickel bath is very important and we maintained 45 to 55^{o}C temperature in the electrolytic bath but we also observed slight variation in temperature from 55^{o}C were causing roughness in sample. It was also seen that due to this excessive temperature of the nickel electrolyte, cracking and dullness in part was observed and it can be cured by maintaing proper temperature in nickel bath (from 45 to 55^{o}C).

In temperature cycle test, in chemical method, specimen's quality was better in comparison to the specimen case of paint method. In this test continuous cycle Parameters like Chemical concentration, current density, temperature, and time cause cracks and roughness. We didn't observe any cracks on the sample but some roughness was observed in sample piece of paint method. And is checked in tool microscope (as shown in Fig.7.)

Fig.7. Roughness in painted part after Temperature

Fig..8 Improper plating and Burning of sample

In Plating thickness inspection with destructive test meter, we know that rate of deposition is directly proportional to current density. So if we increase the current deposition rate will increase and thickness will increase. But it is to be noted that any slight variation in chemical concentration and current density would lead to improper plating in both (chemical method and Conductive paint method) . Thickness inspection with destructive test meter we used SN9, SN5 and SN2 for Cu, Ni and Cr .Thickness of copper, nickel and chrome shown in Table 3.Variation of PH was also observed in chrome bath and in nickel bath. It was concluded that the most recommended PH for nickel bath was PH- 3.5 to 4.2 and with the increase of PH burning starts and causes improper plating.

Since the samples were transferred from one solution to another, pollution of electrolyte was also observed. Due to the pollution, the electrolyte looses it properties and causes decrease in coating thickness. From our research we conclude, Paint method is easy but is not as appropriate for mass production of ABS electroplated parts. And

if we maintain proper temperature, concentration, current density and PH then thickness and quality of product can be increase. The electroplating procedure developed in this study may open up a new route of quality activation of ABS plastics.

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ENGINEERING CHANGE MANAGEMENT: STATE OF THE ART, A CASE STUDY AND PROPOSITION OF A DETAILED MODEL FOR EFFECTIVE MANAGEMENT IN AUTOMOBILE INDUSTRIES

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ABSTRACT

Doing things the right way in first attempt" is what today's demand is. However, talking realistically, the ultra-competitive market condition has led the automotive sector to such a phase where continuous improvement or 'change' is inevitable. With these changes comes the serious need of an efficient as well as effective (Engineering) Change Management (ECM) system.And the organisation which will have a better ECM system will only survive in this market.Various researchers and organisations have come up with their own Change Management System models. However, none of these models discusses the complete management steps incorporating both the process as well as the information flow necessary for an ideal management system amongst the various stakeholders of any Engineering Change (EC).This paper aims at studying thesemodels along with the ECM system of TATA Motors, CVBU-Pune and attempts to suggest a generic ECM model free from the limitations of such models as well as the problems identified in the various ECs studied at TATA Motors. The modeldeveloped can be applied in any automobile industry and with little or no modification to any other complex manufacturing organisations as well.

Keywords: Engineering Change Management, P.L.M., Process-Data Diagrams, System Engineering.

I. INTRODUCTION

Like aeronautical and IT industries, the automobile industry too is undergoing through tremendous increase in complexity levels. And with these complexities comes the continuous engineering changes required in order to survive this ultra-competitive market.

Over the past few years a lot of research has been done to develop a pathway towards efficient Engineering Change Management (ECM) system. Various models have been given by the researchers as well as organisations dealing with ECM systems. However, these models give only the superficial steps for managing the ECs. Also, giving a more holistic view, these models need some restructuring and detailing before they can be applied to automobile industry.

This paper aims at restructuring the entire ECM model giving more detailed steps along with attending to the limitations of the previously given models. Also, it highlights the common factors that result into delaying the implementation of the ECs. In order to better understand the ECM system, a thorough study of various ECs at

the Gear Factory of Tata Motors, CVBU-Pune has been done. The various 'bugs' or factors that delayed the ECs has also been discussed in this paper along with removing them in the proposed model.

II. WHAT IS AN ENGINEERING CHANGE (EC)?

The *US Military Standard 480B* (1988) [1] defines EC as "*an alteration in the approved configuration of a product related item*." An item can be a document or a physical component (virtual or real) of the product structure. The approved configurations of these items move along the product life cycle depending on formal or informal configurations reviews. Wright [2]defines an EC as "*a modification to a component of a product, after that product has entered production*."

In more elaborated way, an EC can be defined as "*an alteration in the existing product in terms of design, configuration or process either at the component level or at an assembly level with the objective to improve quality, reduce cost, lead time or complexity, or to fulfil customer's requirement or solve a problem identified in the existing product*."

Quoting Smith et al. [3], "ECs are part of almost every development process. They result from the fact that engineering is an iterative rather than a purely linear process and are traditionally targeted toward correcting mistakes, integrating components, or the fine tuning of a product." These ECs have a role in improving the product, and efforts to eliminate them entirely are both undesirable and unrealistic [4].

III. WHY ECM?

The change management process in *systems engineering* is "the process of requesting, determining attainability, planning, implementing, and evaluating changes to a system". Its main goal is to support the processing and traceability of changes to an interconnected set of factors.

It is estimated that in North America alone 300,000 ECs take place within the automotive and related industries. Further each EC can cost up to US $50,000 to process (excluding materials and tools) (source: *Automotive Industry Action Group*). Ford, GM and DaimlerChrysler conducted in 2005 an internal count of ECs within their supply chain and came up with around 350,000 ECs per year for the three combined. Feedback from each organization about the costs suggest over US $50,000 per EC. This includes not just hard dollar losses, but also soft/hidden losses such as lost man hours and delays [5].

Also, the OEM members of the German VDA (The German Association of the Automotive Industry) (2006) have more than 1,000 change orders per month, with about 7,000 internal and external users involved in commenting. The average process cost per change is 20,000–50,000 Euros (Daimler-Chrysler AG, Mercedes Car Group). Another estimate for the number of orders comes from the Chief Engineer of Magna Steyr (which engineers, develops and assembles automobiles for other companies on a contractual basis) stating that they can have up to 12,000 ECs in one month for one car project [5]. At TATA Motors, CVBU-Pune alone approximately 4000 major ECs have been either released or are in process of release for the financial year 2014-15.

These figures well explain why there is a need of an effective as well as an efficient EC Management System. The number of 'open' changes, the resources allotted to these changes and the objectives of those changes together make the change management difficult as well as challenging. The negative impact of these ECs have been discussed in a number of studies. ECs can consume 1/3rd to ½ of engineering capacity [6] and represents 20-50% of tool costs [7], which can easily account for over US $100Min large development projects.

Soderberg [6] in his study, reports that about 45% of engineering time was spent on changing components that had been 'thought to be ready'. As a result, the average component was developed at least twice. These research work confirm that 'change' in complex organisations such as automobile itself, is inevitable. Therefore, efforts should be made not in avoiding them but in developing a management system that would ensure a seamless and a bug-free management of these changes.

IV. TRADITIONAL ECM MODELS

Most of the ECM models given by researchers as well as organisations are limited to the five steps: Identify the Need/Potential Change, Investigate/Analyse Change, Evaluate Change, Plan Change and Implement Change. A few researchers (like Marijn Plomp^, etc.) as well as organisations such as PTC and CISCO have included the sixth and very important step as 'Post Implementation Review and Close Change'.

Fig. 1 shows a generic ECP model with complete process divided over three stages namely EC Proposal, EC Investigation and EC Embodiment. Though the model well explains the sequential processes carried out in any EC, it fails to explain the various decision making processes in these stages and the possible outcomes of those decision making processes. Also, the model is linear whereas almost every EC process has an iterative approach which this model fails to explain.

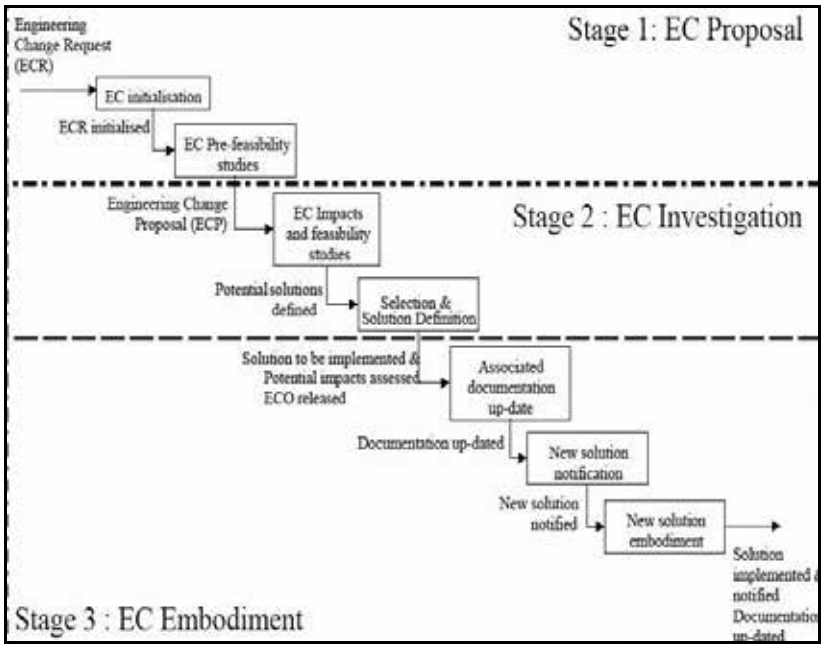

Figure 1- A generic Engineering Change Process (ECP) Model [8]

^ Marijn Plomp is an Assistant Professor at the Knowledge, Information and Networks group at the V.U. University, Amsterdam.

Fig. 2 shows a bit more detailed breakdown of ECM process. However, even this model represents ECM process as a linear process and not an iterative process. Also, both the models does not include the "Post-Implementation Review" step before closing any EC. This step has a very huge significance especially in automobile industries where any EC directly or indirectly affects the entire vehicle assembly and any possibility of mistake means compromising with the safety and lives of passengers. And hence, most of the ECs are reviewed even after implementation. The details of this will be discussed in further sections.

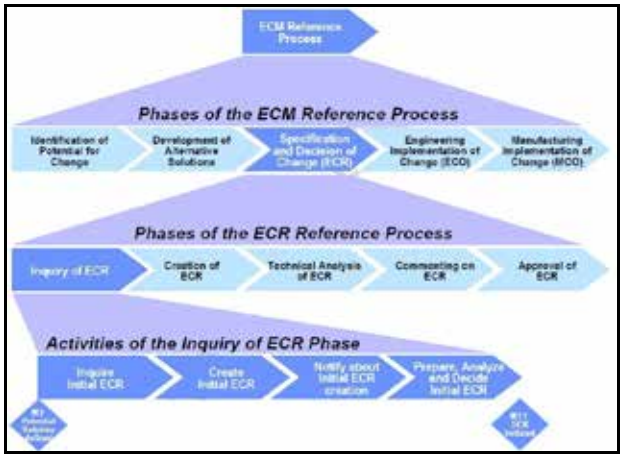

Figure 2- ECM Process Breakdown Model [5]

Fig. 3 shows the change and configuration process flow model of PTC. Unlike previous models, this model has a post-implementation review step. Also, this model explains the various decision making steps that are considered in any EC. However, all the above three models are in absence of any IT support. The absence of IT support such as OMG-PLM (Object Management Group- Product Lifecycle Management) Services, Siemen's PLM Services, etc. make ECM not only difficult but also inefficient and ineffective. Instead of continuously exchanging information, engineers of different functions then meet only at specified milestones or review points to discuss the current status of the project/EC along with the various 'issues' that delays it. In the most extreme cases, the whole product engineering information is packed in one batch and then 'thrown over the wall' to process engineering. Descriptions of such behaviour can be found in Blackburn [9] or Clark and Fujimoto [4].

Quoting McKinsey & Company, "it's typical to see 33% of development cycle time wasted either on unnecessary work, waiting for decisions or waiting for information regarding a change". Besides these wastes, the improper communication may also lead to design and decision conflicts, insufficient change tracking, long response time, etc. A long response time causes late implementation of the final ECR (Engineering Change Request), which is not desirable because of the increasing change costs for tools and interfacing components.

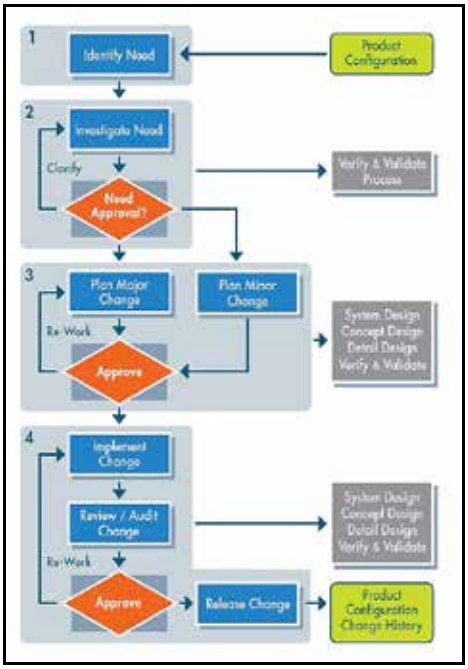

Figure 3- Change and Configuration Process Flow Model by PTC

Fig. 4 shows the normal change process flow model by CISCO. This model covers more iterative processes than previously discussed models. Also, it suggests the use of a central configuration database to maintain a record of all the ECs processed by the organisation. Such a database can help in efficient management of similar ECs in future. Also, the learnings from executed ECs can help in avoiding any previously faced problems.

However, this model does not suggest any active change tracking method that can be used to establish an effective communication channel between the various members of the cross-functional team (CFT) handling the EC along with various CFTs associated with the interfacing components and/or process. Such a communication channel can not only avoid any decision and/or design conflicts but also reduce the decision response time.

The ECM model given by Marijn Plomp, as shown in Fig. 5, is so far the most detailed model that not only incorporates the various iterative phases that are often faced in real-time EC management but also includes the various "change reports" that should be generated and maintained throughout the ECM cycle. These change reports are process and/or stage wise documents that should be developed and maintained by the ECM supporting software package such as PLM. These change reports will help in case of iterating processes and can also be used to trigger the next step in the ECM without causing any delay. Further, as in most ECs, the Central Coordinating Agency can easily keep track and manage the EC along with the propagated changes needed in the interfacing products and/or processes.

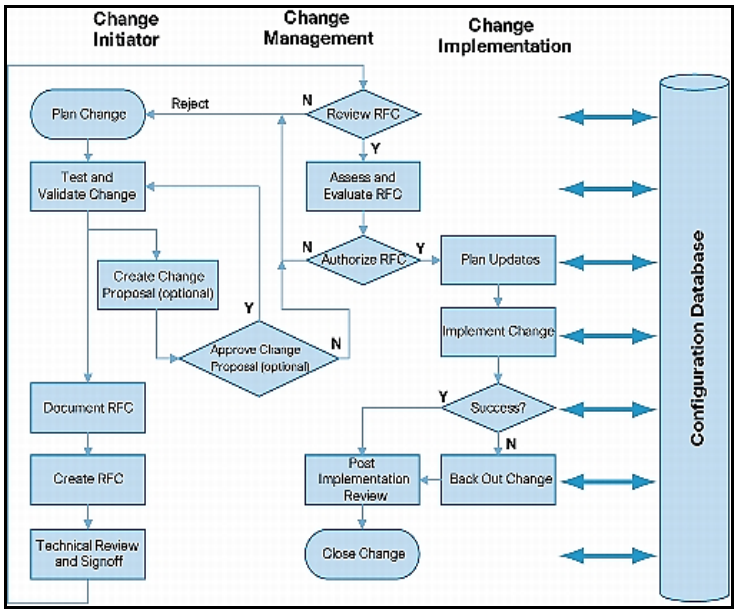

Figure 4- Normal Change Process Flow Model by CISCO

However, even this model along with all the previously discussed models fail to suggest the detailed implementation phase. An effective ECM model should well explain the implementation strategy to be followed for quick and seamless change from the existing product/process to the newly tested product/process without significantly affecting the production and other related activities. An ineffective implementation strategy can further delay the EC implementation by as much as 20-30% along with the significant cost escalation in the EC being carried out.

Also, unlike shown in the model, not all ECs on failing at post-implementation review need to be handled from the execution phase again as it totally depends on the level of modification required in the failed EC. This will be more evident after looking the proposed ECM model discussed in later section.

Thus, the various limitations of the above discussed models can be summarised as follows:

· No or limited in-depth explanation of various phases or steps involved in ECM.

- No or insufficient change tracking.
- No implementation strategy suggested for smooth 'switchover'.
- No or insufficient information sharing.
- Generic but superficial steps of ECM only.

V. DEVELOPED ECM MODEL

Fig. 6 shows the developed ECM model. As evident, this model not only shows the main steps or phases of an ECM but also the detailed sub-steps or processes being carried out in every individual step. Also, it takes into account the various stakeholders of any EC. These stakeholders are the participating departments that form the CFTs for every EC.

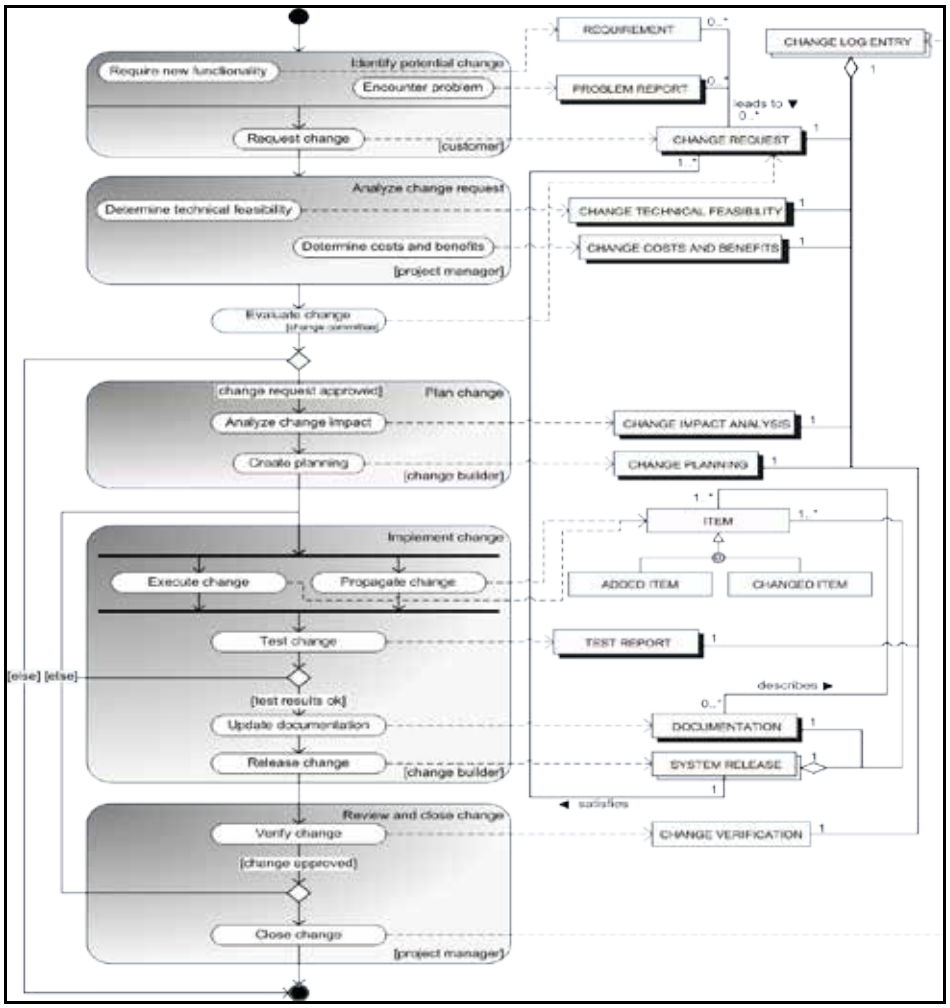

Figure 5- Engineering Change Management model by Marijn Plomp

5.1 Identify Potential Change

Customers being one of the most important stakeholder, they are represented by the Marketing and Quality Assurance (QA) departments. Marketing where brings the 'New Functionality Requirement', QA handles the problems encountered by the customers. Together, the two departments are responsible for initiating any 'change' coming through customers in form of Project Initiation Process (PIP).

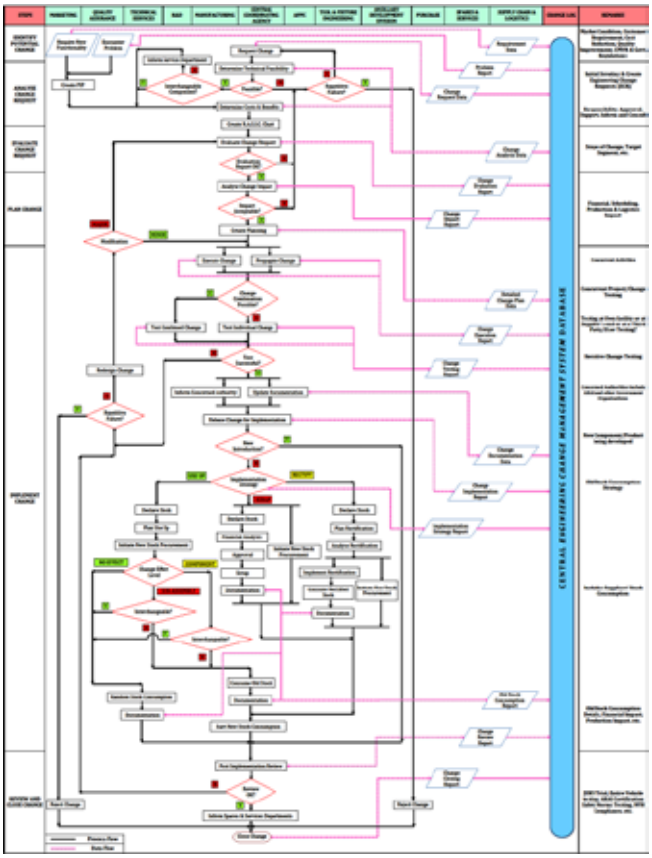

Figure 6- Developed ECM Model

ECs can also be initiated internally by a Central Coordinating Agency, Research & Development or even Manufacturing and similar departments with the objective of cost reduction, quality improvement, complexity reduction, etc. The various causes for initiating an EC has been discussed in detail by Wasmer et al [5] and Pikosz et al [10]. Depending upon the source of change initiation, a report is generated and stored on ECM System database such as PLM, etc.

5.2 Analyse Change Request

Once the 'change' is initiated, the feasibility tests are done and for the feasible 'change' Engineering Change Request (ECR) is created. The details of the feasibility tests conducted are stored in the database which can be used in case the ECR fails at any later stage. After the successful feasible tests, it is essential to communicate the EC related information to Spares & Service department. By doing so, necessary action can be taken to control the spare stock of component(s) affect by the ECR created. In cases where this communication was not established, the implementation phase was delayed in order to consume the old stock.

After the ECR is created and gone through an initial scrutiny, a RASIC (Responsibility, Approval, Support, Inform and Consult) chart is created. This chart summarises the innermost CFT allotted for any ECR created and is very helpful in ensuring little or no time wastage in decision making processes for the same.

5.3 Evaluate Change Request

In evaluation phase, the scope of ECR is determined along with the segment targeted. Based upon the "change analysis report" and benefits of ECR, the RASIC team takes the GO/NO-GO decision. In cases where the scope of the EC is changed at this stage, another iteration of feasibility for the 'revised change' is carried out. The final

evaluation report along with any change in terms of scope, target segment, etc. is generated at the end of this step.

5.4 Plan Change

In this stage, the ECR is viewed with a more holistic approach. The role of Couplings for the EC process, as discussed by Terwiesch and Loch [11], comes into picture and hence an even more detailed analysis of ECR is done as explained below.

5.4.1 Analyse Change Impact

In this sub-step, the change impact analysis in terms of financial, production planning and scheduling, logistics, etc. is done. Also, the impact of ECR on interfacing or coupled product(s) and processes is also studied. Another feasibility study, based on the impact analysis report generated taking into consideration the interfacing components and processes, is carried out before making a GO/NO-GO decision.

5.4.2 Create Planning

In this sub-step the detail planning of ECR for implementation is done. The procurement of necessary tooling and material is also planned. The "batching" of changes at this stage is also very common. Batching of Engineering Change Orders (ECOs) is not an inefficient practice in the presence of conditions described by Loch and Terwiesch [12]. However, the larger the ECO batch size, the longer is the average time between problem detection and final implementation. And in order to avoid this, the strategies suggested by Terwiesch and Loch [11] should be followed.

The detailed planning report generated during this step should be shared with the various stakeholders and CFTs of interfacing components and processes through the ECM database. This will assure least decision making and waiting time in subsequent processes.

5.5 Implement Change

5.5.1 Change Execution

The implementation step beings with the execution of planning done in the previous step. An important aspect that is missing in most of the traditional models discussed in the earlier section as well as in industrial practise is to 'propagate' the ECR execution to the interfacing systems or couplings. That is, the necessary changes in the 'couplings' required to absorb the change impact analysed in previous steps should also begin at this stage. In case this is not done, the change implementation can get delayed by weeks or even months in certain ECs. The detailed execution report generated is shared with the CFTs handling the interfacing systems.

5.5.2 Test Change

The testing step begins with a study on whether this EC can be combined with any other open EC being executed during the same time. As obvious, by doing so the total lead time of two or more ECs combined will get reduced. Besides this, the testing is also planned. The planning includes the various tests to be carried out, whether testing will be done at own facility or at supplier's end or whether a third party testing will be conducted. In some cases the testing can be done even at user's end. It is essential to plan the testing at this stage so as to avoid any further delay in ECR implementation.

The test results are stored in test report and acts as a trigger to initiate documentation. Simultaneously, the successful ECR test reports should be brought to the notice of concerned authorities such as ARAI for

automobile industries, etc. By doing so, any glitches in the testing or any necessary modification needed to adhere to the government regulations can be attended.

5.5.3 Release Change for Implementation

The documentation report of ECR generated after a successful test initiates the process of release for implementation. This process is carried out by the Central Coordinating Agency. Once the ECR is released for implementation, the detailed strategy is planned. The strategy here basically aims at effective consumption of stock (self as well as supplier's) of existing component and smooth changeover to modified component. In case where the EC is a new introduction, the post implementation review process is initiated directly.

However, if the EC is not a new introduction but a modification or development project, the strategy for implementation can be of three types: Use Up, Rectify and Scrap. The "Use Up" strategy says that consume the existing stock depending upon interchangeability of components and change effect level as shown in the model and then move towards full usage of new component. The "Rectify" strategy says that modify the existing component into new component and then consume it before moving on to new component consumption. And the "Scrap" strategy says that in cases where the old or existing component cannot be used any further because of design issues, defects, uneconomical reason or obsoleteness, scrap the complete old stock and procure new components. However, the procurement of new components in last two strategies should be done as a parallel activity as shown in the model in order to reduce any delay in implementation.

5.6 Review and Close Change

5.6.1 Post Implementation Review

Although in most of the cases the post implementation review is more of a formality wherein the complete ECR is presented before the higher management before closing any EC, there were certain cases where an ECR failed to pass the review and was required to redesign and implemented again. In this step, they final jury trial (as is often called in automobile industries) before higher management and/or government authorities is conducted. In case the ECR passes the review trial, change review report is generated and closing of ECR is initiated. Also, requisite information is passed on to Sales & Service department.

5.6.2 Close Change

In this step, the reviewed and accepted ECRs along with the rejected ECRs are closed with a complete final closing report being generated and stored in ECM database. This final report is often used as a reference in similar ECs or in initiating another change.

VI. CONCLUSION

The developed ECM model not only fulfils the limitations of the traditional models but also gives the detailed structure of an effective and efficient ECM system. This model has also taken into account the learnings from various ECs in Gear Factory as well as other divisions of TATA Motors, CVBU-Pune. The problems faced in these ECs have also been answered in this model.

This model takes into consideration the various stakeholders of any EC and also shows the information flow necessary for effective ECM. The departments such as Tooling and Fixture design, Purchase and Logistics, Ancillary Development Division (Vendor's Development) and Spares& Service departments are often left out. However, these departments play a very significant role in ECM and hence should be included in the CFT formed for any EC.

The detailed implementation phase shown in the model makes an EC easy to implement with least possible wastage in terms of time, cost and labour. Also, the possible iterations at various steps have also been taken into consideration. Though this model has been developed for complex organisations such as automobile industry, with little modification it be applied to any industry.

Also, though this model gives a detailed implementation strategy, the problems such as batching, congestion and organisational issues as discussed by Terwiesch and Loch [11, 12] continue to delay the time between EC initiation and final implementation. This delay can amount up to 90% of waiting time [11]. A research work can be carried out here to study the applicability of strategies suggested by them in automobile industries. Also, the validity of 13 Lean Principles of Product Development (given by Morgan & Liker and applied by Strom [13] for ECM in his thesis) on the developed model can also be studied.

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TAGUCHI APPROACH FOR THE DRY SLIDING WEAR BEHAVIOR OF GRANITE AND FLY ASH FILLED GLASS EPOXY COMPOSITES

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ABSTRACT

In this present research the parameter optimization of the wear behavior of Granite filled Glass–Epoxy (G–E) composites has been evaluated by the addition of fly ash as a secondary reinforcement using pin-on disc equipment. By using Taguchi statistical design, the significant controlling factors along with the interactions influence on the specific wear rate of the composites were identified. The results indicate that the addition of Granite in G-E composite increases the wear resistance evidently. It was found that highest wear resistance of G-E composite was achieved by the addition of 10wt. % Granite and 5wt. %fly ash. The presence of different wear mechanisms were analyzed and supported by SEM-micrographic examinations.

Keywords: Two-Body Abrasive Wear, Wear Mechanisms, Anova, S/N Ratio

I INTRODUCTION

Composites can be defined as new age materials that consist of two or more chemically and actually different phases estranged by a distinct interface. The different systems are combined judiciously to achieve a system with more useful structural or functional properties by any of the constituent alone. Polymer can be considered to be one of competitive materials for tribological applications owing to their strength, ease of processing and availability of wider choice of systems. The matrix materiel surrounds and supports the reinforcement material by maintaining their relative positions. The reinforcement imparts their mechanical and physical properties to enhance the matrix properties. The primary function of the matrix material is to transfer stresses between reinforcing fibers/particulate and to protect them from mechanical and/or environmental damages where as presence of fibers/particles in a composite improves its mechanical properties such as strength, stiffness etc.

Wear is defined as damage to a solid surface, generally relating progressive loss of material, due to relative motion between that surface, Abrasive wear is the most important among all the forms of wear. Abrasive wear is caused due to hard particles or hard protuberances that are forced against and move along a solid surface [9]. In two-body abrasion, wear is caused by hard protuberances on one surface which can only slide over the other. Engineering materials and are invariably used in mechanical components, where wear performance in no lubricated condition is a key parameter in the material selection

Wear processes in composites are complex phenomena involving a number of operating variables, and it is essential to understand how the wear characteristics of the composites are affected by different operating conditions. Selecting the appropriate operating conditions is always a major concern because traditional experimental design would require many experimental runs to achieve satisfactory results. In any process, the desired testing parameters are either determined based on experience or by use of a handbook. However, it does not provide optimal testing parameters for a particular situation.

II MATERIALS AND EXPERIMENTAL WORK

2.1. Methodology

The specimen has to be fabricated by using hand lay-up technique. The proper volume fraction of fibers, epoxy, fillers and orientation of fibers are to be controlled. The laminates are cured for a period of about 24 hr. Then the sample is cut to a required size for the tests.

2.2. Materials

The matrix material used was medium viscosity epoxy resin (LAPOX-12) and room temperature curing polyamine hardener (K-6). Supplied by YUJE ENTERPRISES Bangalore, This matrix was chosen, since it provides good resistance to alkalis and good adhesive properties. The reinforcement material employed was 7-mill E-glass fiber. The filler used was granite and fly ash.

Epoxy resin was used in the present investigation, the most widely used matrix material for advanced composites have been the epoxy resin. Epoxy resin systems have achieved acceptance as adhesives, potting compounds, molding compounds and as matrices for continuous filament composites used in structural applications. Epoxy molecules in the pure state at room temperature normally do not react with each other and can sit for years in a dry container without mutual reaction. In the present work Hardener (K-6) is used. This has a viscosity of 10-20 poise at 25^{o}C. Depending upon the resin and hardener compressing the system, the amount of hardener can vary as low as one part of hardener per 100 parts of resin.

E-glass fibers are the most common basic material for reinforced plastics. They are also used in a lot of other applications, ranging from telecommunications to insulation materials. Of the various types of glass fibers, E-glass is by far the most important with a market share of about 99%. For special applications R-glass or S-glass are used which have a higher modulus and applicable in an alkaline environment.

Granite is a hard, tough, igneous rock that is widely distributed in the Earth's continental crust. It is medium to coarse-grained and consists of a number of minerals, especially members of the feldspar group and quartz. It varies in composition and comes in a range of colors, such as white, red, pink, gray, and black, often occurring in combination. Given its ruggedness and wide distribution, it has been used as a construction stone since antiquity

Fly ash is a derivative of the combustion of coal mainly in large electricity generating coal power stations. The production of cement requires quantities of clay or sand. Fly ash is used as an alternative raw material in the cement production process as substitute to base raw material

III PREPARATION OF COMPOSITES

The Glass–Epoxy- Granite and fly ash composite used in this work is made from the hand lay-up technique. The procedure consisted of placing the glass fibers-epoxy with granite and fly ash compatible finish on a substrate material which had a release coat applied on it. A curing agent (hardener) is mixed in the epoxy (1:10 ratio) with Granite and fly ash to polymerize the polymer and form a solid network cross-linked polymer. Weighed quantities of epoxy resin- Granite and fly ash plus hardener mix was taken and smeared over the glass fabric. On this, another layer of the glass fabric was laid and the process continued. The whole layup was covered with a mat finished fabric over which steel plate was placed with the necessary release coat applied on it. [1] The layup assembly was pressed in a press. The excess resin was allowed to squeeze out. The laminate was cured at ambient conditions for a period of about 24 hr. The composites are fabricated and cured as reported by Basavarajappa et al [1]. And Suresha et al,[2,3] and The laminates so prepared has a size of 300 mm × 300 mm × 3 mm to prepare the filled glass-epoxy- Granit and fly ash composites, fillers are mixed with a known amount of epoxy resin. The details of the composites prepared are shown in Table 1

Table 1. Filler Material Composition

Sl. No	Material Code	Matrix(Epoxy) %volume	Reinforcement (Glass fiber) % volume	Filler (Granite) % volume	Filler (Fly ash) % volume
1	A	50	50	0	0
2	B	50	40	5	5
3	C	50	35	10	5

3.1. Specimen Preparation

After the preparation of composite material, the cured composite materials have been cut by diamond tipped cutter to yield the testing specimens of dimensions 10mm×10 mm×3 mm. The geometry of two body wear testing specimen has been done. The surface of the sample (10mm × 10mm × 3mm) glued to a pin of 10X10 mm Bar and 45 mm height.

3.2. Experimental Procedure

A pin-on-disc test apparatus was used to investigate the two body wear characteristics of the composites as per ASTM G99-95 standards. The disc used is En-31 steel hardened to 60 HRC, 165mm track diameter and 8mm thick, with surface roughness of 10μm Ra. The tests were conducted by selecting test duration, load and velocity and performed in a track of 60mm diameter. The glass fabric layers in the composites are parallel to the contact surface and to the sliding direction. The surface of the sample (10mm × 10mm × 3mm) glued to a pin of 10×10mm cross section and 45 mm height of the composites specimen makes contact to the counter surface. Prior to testing, the samples are rubbed over a 150, 320 and 600 Grit Silicon carbide paper to ensure proper contact with the counter surface.

Fig.1: Schematic Diagram of Pin on Disk Apparatus

3.3. Statistical Design of Experiment

Design of experiment is the powerful analysis tool for modeling and analyzing the influence of the control factors on the performance output. The most important stage in the design of experiment lies in the selection of the control factors. Therefore, a large number of factors are influenced so that non significant variables can be identified at the earliest opportunity. The standard liner graph by Glen for the analysis as shown in figure is used to assign the factor and interaction to various column of the orthogonal array. The plan of the experiment is as follows: the first column is assigned to the applied Load (A), the second column is to Abrading distance (B), the fifth column to the filler content (C), the ninth column Abrasive paper grit size (D), For analysis of specific wear rate third and fourth column are assigned to $(A \times B)_1$ and $(A \times B)_2$, respectively , to estimate interaction between Load (A) and Abrading Distance (B), the sixth and seventh column are assigned to $(B \times C)_1$ and $(B \times C)_2$, respectively, to estimate the interaction between the Abrading Distance (B) and Filler Material (C), The eighth and eleventh column are assigned to $(A \times C)_1$ and $(A \times C)_2$, respectively to estimate the interaction between the Load (A) and Filler Material Content (C), The remaining columns are assigned to error columns respectively,

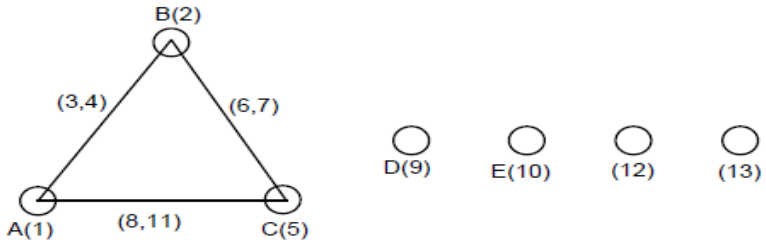


Fig.2: Linear Graph For L_{27} Array

Whereas for the analysis of coefficient of friction of third and fourth column are assigned to $(B \times C)_1$ and $(B \times C)_2$, respectively, to estimate interaction between Abrading Distance (B) and Filler Content (C), the sixth and seventh columns are assigned to $(C \times D)_1$ and $(C \times D)_2$, respectively, to estimate the interaction between the Filler Content (C) and Abrasive Grit Paper (D), the eighth and eleventh column are assigned to $(B \times D)_1$ and (B

X D)$_2$, respectively, to estimate the interaction between the Abrading Distance (B) and Abrasive Paper Grit Size (D) the remaining columns are assigned to error columns respectively,

IV RESULTS AND DISCUSSION

4.1. Taguchi Analysis of Specific Wear Rate

The analysis is done using MINITAB 16. Test result obtained are given in table 2

Table 2: Taguchi set of experiments

Sl no	Load (N)	Distance (m)	Composition	Grit size (µm)	Weight Loss TW	Wear volume loss (ΔV)m^3 $\times 10^{-9}$	Specific wear rate (k_S) m^3/Nm $\times 10^{-11}$	s/n ratio
1	5	25	A	150	0.0084	4.5652	3.652	-11.250
2	5	25	B	320	0.0123	6.9023	5.5218	-14.841
3	5	25	C	600	0.0051	2.8523	2.2818	-7.1655
4	5	50	A	320	0.0083	4.5108	1.8043	-5.1261
5	5	50	B	600	0.0052	2.9180	1.1672	-1.3429
6	5	50	C	150	0.0149	8.8333	3.3333	-10.4574
7	5	75	A	600	0.0042	2.2826	0.6086	4.3133
8	5	75	B	150	0.0126	7.0707	1.8855	-5.5085
9	5	75	C	320	0.0077	4.3064	1.1483	-1.2011
10	10	25	A	320	0.0201	10.9239	4.3695	-12.8086
11	10	25	B	600	0.0077	4.3209	1.7283	-4.75238
12	10	25	C	150	0.0682	38.143	15.257	-23.6693
13	10	50	A	600	0.0181	9.8369	1.9673	-5.8774
14	10	50	B	150	0.0576	32.3232	6.4646	-16.2108
15	10	50	C	320	0.0435	24.3288	4.8657	-13.7429
16	10	75	A	150	0.1835	99.7282	13.297	-22.4750
17	10	75	B	320	0.0305	17.1156	2.2822	-7.1670
18	10	75	C	600	0.0089	4.9776	0.66368	3.5608
19	15	25	A	600	0.0125	6.7934	1.8115	-5.16076
20	15	25	B	150	0.1190	66.7789	17.807	-25.0118
21	15	25	C	320	0.0321	17.9530	4.7874	-13.6019
22	15	50	A	150	0.3180	172.82	23.040	-27.2496
23	15	50	B	320	0.0339	19.0235	2.5364	-8.0843
24	15	50	C	600	0.0130	7.2706	0.96942	0.2697

25	15	75	A	320	0.0322	17.5	1.5555	-3.83740
26	15	75	B	600	0.0144	8.0808	0.71829	2.87400
27	15	75	C	150	0.1532	85.6823	7.6162	-17.634

The aim of the experimental plan is to find the important factors and combination of factors influencing the wear process to achieve the minimum wear rate. The experiments have been developed based on orthogonal array, with the aim of relating the influence of load, sliding distance, composition, grit size. These design parameters are distinct and intrinsic feature of process that influence and determine the composite performance. Taguchi recommends analyzing the S/N ratio using conceptual approach that involves graphing the effects and visually identifying the significant factors.

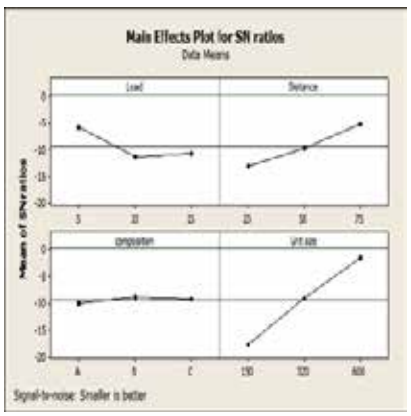
The investigational results and calculated values have been obtained based on the plan of experiment and then the results were analyzed with the help of commercial software MINITAB 15 specifically used for design of experiment application. The influence of controlled process parameters such as load, sliding distance, composition, grit size has been analyzed and the rank of involved factors like wear rate which supports signal to noise ratio response is given in table.

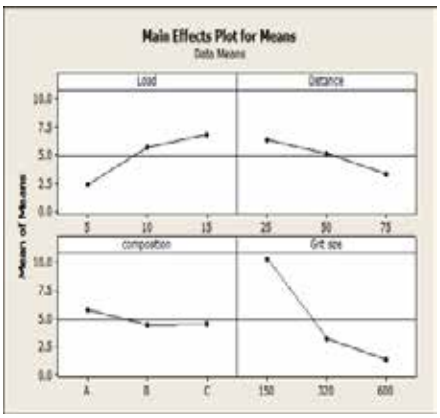
Table 3:Response for signal to noise ratio- smaller is better

Level	Load (N)	Distance (m)	Composition	Grit size
1	-5.816	-13.115	-9.941	-17.719
2	-11.46	-9.758	-8.894	-8.934
3	-10.826	-5.23	-9.268	-1.45
Delta	5.644	7.884	1.047	16.269
Rank	3	2	4	1

It is evident from the table3 that, among these parameters, Grit size is a dominant factor on the wear rate. Figure shows graphically the effect of the four control factors on wear rate of the composite specimens.

4.2. Main effect plots for means and S/N ratio





A main effect is seen when different levels of a factor affect the response differently. A main effects plot graphs the response mean for each factor level connected by line. When the line is horizontal, then there is no main effect present. Each level of the factor affects the response in the same way, and the response mean is the same across all factor levels. When the line is not horizontal, then there is a main effect present. Different levels of the factor affect the response differently. The steeper the slope of the line, greater is magnitude of the main effect on the wear rate. For each control factors, a level with maximum value of mean of S/N ratio will give maximum wear rate. In this case, material code B, with 5 N load, 75 m sliding distance and grit size of 600 µm will lead to a minimum wear rate.

When the effect of one factor depends on the level of the other factor, interaction plot can be used to visualize possible interactions. Parallel lines in an interaction plot indicate no interaction. The greater the difference in slope between the lines, the higher is the degree of interaction. From the interaction plot shown in figure it is observed that the interaction A x B x C i.e., load, sliding distance and percent filler shows significant effect on the wear rate of the composite samples.

4.3. Analysis of variance

Analysis of variance is a statistical tool used to compute the quantities and their significance in order to find out the effect of various factors like fiber loading, normal load, sliding distance and abrasive particle size on specific wear rate of granite and fly ash filled glass fiber reinforced epoxy composites, analysis of variance (ANOVA) is performed based on Taguchi experimental results. Table shows the results of the ANOVA with the specific wear rate of granite and fly ash filled glass fiber reinforced epoxy composition taken in this investigation. The analysis has been evaluated for a confidence level of 95%, that is for significance level of α=0.05. The last column of table shows the percentage of contribution (P %) of each parameter on the response, indicating the degree of influence on the result.

Source	DOF	Seq SS	Adj SS	Adj MS	F	P	%
Load	2	170.41	170.41	85.207	7.58	0.023	8.547
Abrading distance	2	283.5	283.5	141.75	12.6	0.007	14.219
Filler material	2	5.03	5.03	2.515	0.22	0.806	0.252
Abrasive Grit size	2	1189.89	1189.89	594.947	52.9	0	59.68
Load x Distance	4	23.7	23.7	5.926	0.53	0.721	1.188
Load x Filler material	4	46.9	46.9	11.726	1.04	0.458	2.352
Load X Abrasive Grit size	4	206.84	206.84	51.71	4.6	0.049	10.374
Residual error	6	67.48	67.48	11.247			3.384
Total	26	1993.76					100

It has been observed from the from the result that Abrasive Grit size is the most significant parameter having the highest statistical influence (59.68%) on the dry sliding wear of composite followed by Abrading or sliding distance (14.219%). Among interaction terms, interaction between Load and abrasive grit size have a significant influence (P=10.374%) on wear rate of the composites. Other interactions are below the confidence level of

0.05. The pooled error is very low, accounting for only 3.38%. From the analysis of variance and S/N ratio, it is inferred that the Abrasive Grit size has the highest contribution on wear rate followed by abrading distance and load.

4.4. Multiple linear regression models

A multiple linear regression model is developed using statistical software MINITAB 15. This model gives the relationship between an independent/ predictor variable and a response variable by fitting a linear equation to observed data.

Specific wear rate= 10.2 + 0.438 Load - 0.0610 Distance - 0.0186 Grit Size (1)

The above equation has been used predict the wear rate of the composites. The constant in the equation is the residue. From regression equation it has been found that wear rate of composite is directly proportional to load and inversely proportional to sliding distance and grit size.

V CONCLUSIONS

The experimental and statistical analysis have been carried out for dry sliding abrasive wear test on glass epoxy, granite and fly ash reinforced composites the following conclusions have been drawn:

1. The wear testing experiment have been carried out at a sliding distance of 25, 50, 75 m at three different loads of 5, 10, 15 N for three different compositions of material A, B, C under three different Abrasive grit size of 150, 320, 600 µm.
2. From Signal to Noise ratio smaller the better have been chosen since the wear has to be reduced in the material composition.
3. From ANOVA it can be seen that Abrasive grit size and abrading distance are influencing the wear rate and also the percentage contribution of each factors that are affecting the responses.
4. Investigation on the effectiveness of granite and fly ash on the wear performance of composites has been reported. Specific wear rate decreases with abrading distance and increases with abrading grit size. Granite and fly ash reinforced glass epoxy composites shows better wear resistance as compared to that of unfilled G-E composite.

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PROJECT COMMUNICATION : IS KEY TO PRODUCTIVE CONSTRUCTION AND IT'S RESEARCH NEEDS IN THE FUTURE OF CONSTRUCTION ENGINEERING AND MANAGEMENT

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ABSTRACT

In construction industry, project communication is the soul of project management. By taking a closer look at the three main phases of construction projects - initiation, execution and closedown we can try to determine the role and impact of communication during each phase. Statistics shows that 74% of construction projects are unsuccessful. One of the many factors that contribute to the failure of these projects is poor communication management among the project participants. This paper discusses the results of a literature study of the extent to which poor communication management influences impact on organization performance and project success. It focuses on the particular factors within the categories of culture, human resource management, leadership, technology and communication skills. It also investigates the communication strategies employed by project managers and their effectiveness in communicating within an organizational context. As an ending of the literature study, it is evident that one of the leading factor for the cause of time delays and cost overruns is due to inefficient information exchange between the various project stakeholders. In this study, through questionnaire survey among project stakeholders the barriers of effective communication and inefficiency of existing communication protocol is to be identified. As an end to this study, based on the learning's from the literature and interview survey, the communication protocol based on latest technology will be developed and recommended to avoid information related cost and time overruns and to improve organization performance resulting in project success.

Keywords - communication protocol, cost overrun, latest technology, project management, time delay

I.INTRODUCTION

1.1. General

Construction industries play an important role in economic growth of developing countries and it is long-familiar combating with numerous uncertainties. The expansion of construction sector widely spreads out with an increased complexity of management of construction projects. Communication is the soul of project

management. Communication, Communication, Communication! In the world of project management today, it has become increasingly more important to turn the efforts toward more effective means of communication. As blood flows, it pumps oxygen through the body to sustain life. Likewise, communication is the lifeblood of projects and organizations. Information and communication are an integral part of any construction effort. The table below introduces the current practice and future vision standards for communication on a construction project or program.

Table 1 - Vision for future communication

Timeframe	Communications Charaterizations
Current Industry Practice	Traditional design-bid-build procurement Information manually managed (within a computer) Limited communication Limited integration Sharp divisions between project participants
Future Vision	Integrated development of design by all project parties Immediate access to all project information by all parties in all phases Virtual smart models guide design and construction processes No division between project particpants Shift from project to program emphasis

1.2 Project Communication

Project communication is the exchange of project-specific information with the emphasis on creating understanding between the sender and the receiver. Project communication is the responsibility of everyone on the project team.

1.3 Effective Communication

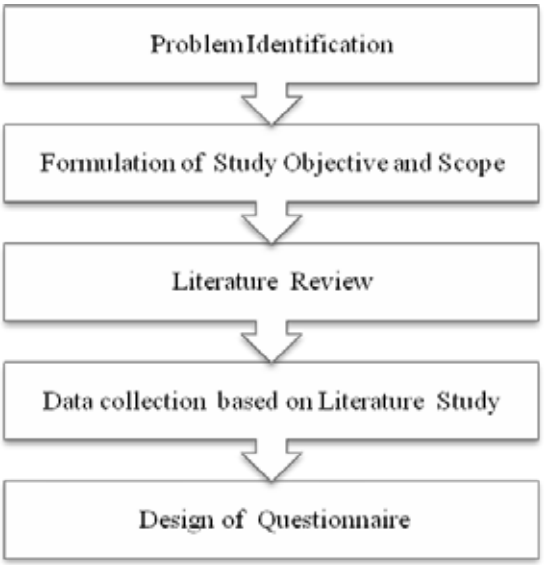
Effective communication means that the information is provided in the right format, at the right time, and with the right impact. Effective communication is one of the most important factors contributing to the success of a project.

1.4 Efficient Communication

Efficient communication means providing only the information that is needed.

II.METHODOLGY (DATA COLLECTION

This study involved data collection on barriers of communication and problems resulting from inefficient communication in construction projects through "Literature Study" and "Interview Survey". Analysis of data helped in developing the questionnaires based on relationships amongst the identified key problem statement with the focus on the project stakeholders. The questionnaire has been designed for quantitative analysis by statistical analysis tools and contains structured questions. To this end, a pilot study has been conducted to test the effectiveness of the questionnaires and questionnaires was finalized.



III.PROBLEM STATEMENT

Ineffective communication management system in construction project delivery is the major cause of failures associated with construction projects. As such, the problems of communication in construction project delivery are enormous. As the project unfolds and the design is realized, information in the form of drawings, specifications and construction methods must be communicated from one expert to another.(Foley, 2005), and communication poorly managed will lead to de-motivated workforce, design errors, slowdown in the entire job and failure in production. Therefore, using an appropriate communication management system to resolve construction and design problems is essential.

One of the most serious barriers that any company faces is to resolve the problem of information is use of appropriate communication and communication medium. To resolve construction and design problems is proper communication medium is essential. In order to fully appreciate the problem of communication in the construction industry, the following questions have been articulated for study:

(1) How much value do constructional project professionals place on communication?
(2) How have project professionals managed communication on construction projects in present scenario?
(3) What are the causes of communication barriers on construction projects?
(4) What are the various communication channels used by project professionals on a project?
(5) Does construction project communication affect project delivery?

IV.STUDY OBJECTIVE AND SCOPE

The objective of this study is to review the past studies related to inefficiencies in construction communication, their rankings and related communication management models application to develop a communication protocol for Indian construction industry. The study aim is to critically assess project communication among the project stakeholders however, the specific objectives of the study are as follows:

(1) To determine the applicability of the past studies in Indian scenario
(2) To find out the problem of poor communication in construction projects
(3) To find out the important factors responsible for ineffective communication (contractual barriers, cultural barriers, technology barriers, or human personality barriers)
(4) To study the existing effective communication methods and its inefficiency and
(5) To find out the need of advancement of communication tool/protocol in future.

The study scope is to critically improve project communication among the project stakeholders however, the specific scope of the study are as follows:

(1) To improve the performance and profit of an organization.
(2) To ensure timely completion and success of the project.
(3) To standardize the communication system in construction to avoid improper and miscommunication.
(4) To minimize information related time delay and cost overrun in a project.

V. LITERATURE REVIEW

A systematic literature review on project communication management and problems of delivering effective communication of construction project was carried out. The articles on risks curtailed with ineffective communication in construction project were searched from various sources (Journals, Proceedings, Web). A much larger number of papers were examined. The papers related to communication in construction project, articles identifying factors for ineffective communication and assessing better communication protocol for construction project were selected. The editorial published on tools and techniques used for communication management in current trend and future research needed were also selected. In-order to understand communication in construction in a better way, concepts of communication instruments, items, tools, requirements, types, methods and plan is studied in detail through literature study and interaction with project stakeholders. The literature review is classified into three where first section focuses on communication problems (both barriers of communication and effects of inefficient communication) in the construction industry; section two focuses on the concepts of communication management in construction and section three focuses on the researches in improving communication in construction. As an outcome of literature study and to prove the past studies practically, a questionnaire is developed to examine the underlying factors influencing effective communication in construction site.

5.1. Findings from Literature

Table 2 - Key findings from literature reviews

Section	Key findings
I	- Effect of inefficient communication on construction projects - Barriers of effective communication in construction - Potential problems of communication in different phases of project (initiation, execution and closure phase)
II	- The total number of prospective communication channels is determined by the formula *n(n-1)/2.* - Communication plan development and its importance - Communication tools, items and methods commonly used.
III	- Focused problem definition, - Main study objective and scope, - Possible study methodology to tackle the problem and - Questionnaire for improving communication in construction

VI. RESEARCH METHODOLOGY (DATA ANALYSIS)

The research methodology contains two phases. The first phase included a literature search and interviews. The literature review was conducted through books, conference proceedings, internet and international project management journals. As the outcome of this phase, importance of effective communication and its barriers in construction projects were identified. Framework of the barriers of effective communication and its effect on construction project is given in Table 2. The second phase includes preparation of questionnaire based on RII approach used for giving ranking to importance of effective communication in construction projects.

Table 3 - Barriers of communication and its effect on construction projects

Barriers of effective communication	Effect of inefficient communication on construction projects

-Poor listeners -Poor leadership -Unclear communication objective -Organization structure -Unclear channels of communication -Ineffective reporting system -Ineffective communication between project participants -Limited resources -Information filtering -Lack of necessary skills -Stereotyping -Language difficulties -Physical distance between the project participants	-Time delay in project -Cost overrun due to rework -Lack of co-ordination -Lack of Quality -Poor performance of organization -Procurement delay -Misunderstanding / Misrepresentation -Scope change -Failure of project -Risk initiation during closeout phase -Disputes and Arbitration

6.1. Data Analysis Approach

The *Relative Importance Index technique* is used for data analysis. Kometa et al. used the Relative Importance Index method to determine the relative importance of the various barriers of effective communication and effects of barriers. The same method is going to adopted in this study within various groups (i.e. clients, consultants or contractors). The five-point scale ranged from 1 (not important) to 5 (very important) is adopted and will be transformed to relative importance indices (RII) for each factor as follows:

$$RII = \sum w / A * N$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 5 (0 not inclusive), higher the value of RII, more important was the barrier of effective communication.

VII.CONCLUSION

Since there has been no empirical work that quantifies explicitly the extent to which communication determines the success of construction projects and to address the increasing global nature of construction projects, an attempt to study barriers of communication and problems resulting from inefficient communication in construction projects through "Literature Study" and "Interview Survey" is made. Analysis of data helped in developing the questionnaires based on relationships amongst the identified key problem statement with the focus on the project stakeholders. The questionnaire has been designed for quantitative analysis by statistical analysis tools and contains structured questions. To this end, a pilot study has been conducted to test the effectiveness of the questionnaires and questionnaires was finalized. Through questionnaire survey among project stakeholders it is proposed to carry out ranking of barriers of effective communication from RII technique and examination on how communication can be made effective in construction project environments by overcoming the existing barriers using technological advancements in the next phase of research.

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PRIVATE KEY ENCRYPTION WITHALGORITHM FORMULA QUESTION

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ABSTRACT

Now a day's data security is very important. Encryption is one of the best and effective way to achieve/provide Data security. This is done by converting the Plain text into Cipher text by encryption algorithms. There are few Armstrong number UPMM algorithm, unprintable characters algorithm. Therefore cryptanalyst can easily find the key & decrypt the message. In this paper we are proposing a new algorithm for encryption technique formula question algorithm. With 3 way encryption,this is applied on the ASCII value of data which makes very strong cipher text. ASCII value are encrypted using a key generated by the third party called system (Randomized) using formula, Which involves the Data itself, Time, word length, character position and system generated key with numeric operation.This paper gives a technique to send the secured data over the network. Encryption is done by formula question algorithm with three way encryption. In this technique secure description is also done. For achieving decryption a secrete key is used which is generated by the third party or system same as key of encryption.

In our algorithm original message get converted into cipher text 3 time by 3 way technique using word length – position and 4th/final round with formula question technique. So for hacker task, he gets problematic when he tries to decrypt the message.

Keywords: Date-time format, Decryption, Encryption, Key, Length, Position, Size

I. INTRODUCTION

Security of the electronic information, confidential and important data is very important. One of the best ways to provide security is encryption.

Now a days there are many algorithm based on the ASCII value of characters to encrypt the data but these algorithms are not much secured hence cryptanalyst can access the information.Information Security is very important, because internet is the fastest way to send/receive and store the information. Cryptanalyst always try to get your confidential and important information. To avoid this Information Security is the best approach, for this Encryption of cryptography is used. Encryption technique helps us to secure our confidential and important information from outside world/ Hackers. Encryption algorithms provide the technique by which we convert our plain text into cipher text and then send this converted and complex message i.e. Cipher Text to the receiver. Then receiver can receives that information and then convert that cipher text back to plain text to obtain original message.

II. PROBLEM STATEMENT

Now a day's there are many algorithms are used for the Encryption technique. Some algorithms are Asymmetric and some are Symmetric, some algorithms are based on the ASCII value of the characters. There are so many

algorithms based on ASCII value such as UPMM, unprintable characters algorithm, Armstrong number algorithm etc. this algorithm are not much secured so a cryptanalyst can easily come to know the plain text of the cipher text he has.

There is no such algorithm which we can generate the plain text in the form of question marks (?) to confused the cryptanalyst. This paper we are introducing the new algorithm based on the ASCII value of the characters to provide better security and way of encryption of the plain text.

III. PROPOSED SYSTEM

3.1 Overview

The proposed system is based on question mark (?).Figure (1) shows the overall view of proposed system. This system is work on the ASCII values of the characters. The security of data transmission can be increased by selecting most secured way. In proposed system the 4 way encryption scheme is used. In which 3 times the message is encrypted by the algorithm of word length- position and at time of data store or send the formula question algorithm is used.

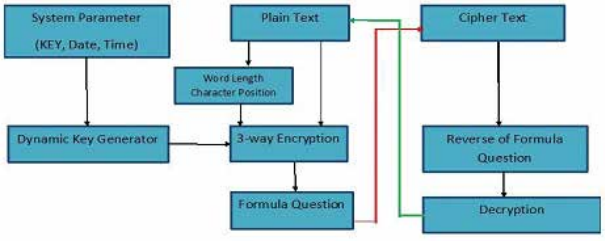

Fig.1: System Overview

The system parameters i.e. key, date, time are used to generate key. Dynamic key generator generate key for encryption. The word length of word and position of every character then send to the 3-way encryption function. Then Formula Question is applied on that cipher text generated by the 3-way encryption function. So now the generated cipher text is in the form of question marks. This is the final cipher text.At the decryption end the reverse method of the Formula Question is used first to get the original cipher text. So now the question marks are removed from the cipher text to get the plain text. Then cipher text send to the decryption function to get the original plain text. By using this algorithm we can achieve the following goals-

- We can achieve the secured message transmission
- The key is generated by third party called as system itself.
- We not only achieved the authentication and identification but also confidentiality and integrity of message.

3.2 Related Work

The existing system works on the palindrome and Armstrong number with the ASCII value of the characters. Some systems work with the unprintable characters algorithm. This section contains the short review of the system. Algorithm formula question is new approach provide the better security. In this system the encryption is done on the ASCII value of the character, for this following steps are followed:

- Take system generated key
- Take system date and perform the date formatter function on it.
- Send result of date formatter to key generator
- Dynamic key generator generate the key depends on following parameters:
  - System key

- System date
- System time
- Find length of word
- Find position of the character
- Then dynamic generated key, word length and character position send to the function key generator for every character.
- Now encryption function works on the plain text, with 3-way encryption.
- Now Formula Question is applied on the cipher text generated by the encryption function and then the cipher text generated by the formula question is the final cipher text.

IV. MATHEMATICAL MODEL

In the encryption process we use the symmetric key generation algorithm. To generate the secure algorithm we provide the three way encryption technique. In this we use the one constant key (K) and other dynamic keys which is generated by the system at the encryption time.

Step 1:

K1= Predefined key which we used for E.

Step 2:

K2=K1*D ---------- (1)

Where K1=Previous key

D=Current Date

In this step we take a previous key and current system date. Then we multiply both and generate the new key. In this date is the combination of the dd/mm/yy. So generate the number add all the integers in the current date.

D=dd+mm+yy.

Eg. 12/06/2014

D=1+2+6+2+1+4=16=1+6=7

D=7

Step 3:

K=K2+T ---------- (2)

Where K2=Previous key

T=Current System Time

In this step we take a key which is generated in equation (1) and current system time and add both numbers to get a new key. In this time is the combination of the HH:MM. So generate the number we add the all the integers from the current time.

Eg. 12:23

T=1+2+2+3=8

T=8

In the previous three steps we are generate the one key by using some dynamic system keys which we used in encryption.

Key used in Encryption:

Encryption process may require the one key (K), word length (L), and position of character in the word (P). When we take a message as an input then we divide it into words so each word has its own length.

E=K+L*P

Where E= Encrypted function

K= Generated Key

L= Word Length

P= Position of the character in the word

Example:

Given

M= “Welcome to SKNSITS”

K1= 3

D=23/11/2014

T=03:46

Step 1:

K1=3

D= 23/11/2014

= 2+3+1+1+2+1+4

= 14

= 1+4

= 5

T = 03:46

= 3+4+6

= 13

= 1+3

= 4

K2=3*D

= 3*5

= 15

K=K2+T

= 15+4

= 19

Generated Key (K) = 19

Step 2:

K=19

M= “Welcome to SKNSITS”

In this we divide message into the words.

W1=Welcome

W2=to

W3=SKNSITS

Encrypted W1:

L=7

E (W1) =ASC(W)+(17+7*1) ASC(e)+(17+7*2) ASC(l)+(17+7*3) ASC(c)+(17+7*4) ASC(o)+(17+7*5) ASC(m)+(17+7*6) ASC(e)+(17+7*7)

E (W1) = e$|kskx

Encrypted W2:

L=2

E (W2) = ASC(t)+(17+2*1) ASC(o)+(17+2*2)

E (W2) = wp

Encrypted W3:

L=7

E(W3)=ASC(S)+(17+7*1) ASC(K)+(17+7*2) ASC(N)+(17+7*3) ASC(S)+(17+7*4) ASC(I)+(17+7*5) ASC(T)+(17+7*6) ASC(S)+(17+7*7)

E (W3) = $€|$ □z~„{‡‡

Cipher Text: e$|kskxwp $€|$ □z~„{‡‡

Step 3:

To generate cipher text key management concept helps a lot. Using any one combination from key management cipher text is generated. There are 8 combinations of key which used to generate the cipher text.

Step 4:

Now Formula Question is applied on the cipher text generated by the encryption function, then cipher text generated by the formula Question is used as final cipher text.

Formula Question (Cipher Text):????????????? ‡‡??

V. KEY MANAGEMENT

Key is very important part of the system for working of the algorithm on the plain text. In this algorithm we use four different and unique keys. First key used to encryption in round one. After that these encrypted cipher texts again encrypted by the Second key in round two. Third key used to complete encryption process in round three. These three keys are work on the text to encrypt the message according to the following combinations.

E(Encryption)

D(Decryption)

1] E EE

2] E E D

3] E D E

4] E D D

5] D E E

6] D E D

7] D D E

8] D DD

If you use the combination number 3 (i.e. E D E) then, following process take place:

- The original Plain text encrypted using FIRST key. Then the cipher text (CT1) gets generated and sends for further process.

- Then using SECOND key the CT1 is decrypted. Then the cipher text (CT2) gets generated and sends to next round.
- Then using the THIRD key the CT2 is again encrypted. Then the main cipher text gets generate i.e. CT3. This CT3 sends to Formula Question to complete the process and to provide more security.

The fourth key is used by the formula question. The fourth key is actually not the encryption key; this is generated by the Dynamic key generator or by the function key generator for every character, its special key only known by the system. Only system can access this key, no other person (authorized / unauthorized) can access this key. The Formula Question function uses this FOURTH key to generate the Final cipher text (FCT). The final cipher text contains only the question marks.

VI. TECHNICAL REQUIREMENT

The following technical requirements were chosen as a basis for pothole detection system:

- System should be able to format the system date in real time.
- System should be able to generate key using the system key and the values generated by the date formatter.
- The system should be able to run on different operating system and on the different smart phones with different parameters or with different operating system.
- The system must able to generate cipher text using formula question i.e. system should encrypt and decrypt the message/data using the formula question.

VII. FLOW CHART

Figure (2) shows the working flow of the system. In this system the dynamic key generation is very important. Using the key generated by the dynamic key generator the whole working of encryption process done here.

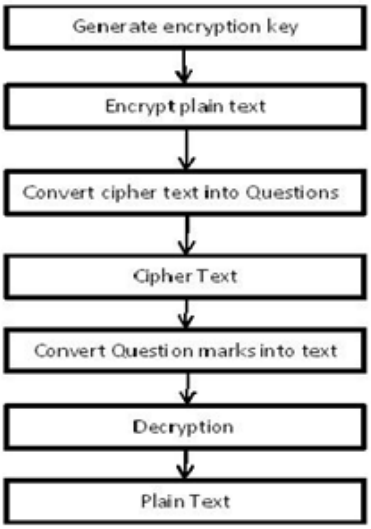

Fig.2: WORKING FLOW OF SYSTEM

Fig.3: Result of the System.

In the Figure (3), Plain text message is converted into cipher text which is nothing but the almost question marks. This cipher text (question marks) is the final cipher text which is send over the network, so it's very powerful and secured way. This cipher text can be decrypted only when it converts back to the original cipher text removing question marks. Then decryption function works on this cipher text and obtains the original plain text.

VIII. CONCLUSION

In this paper we used the ASCII based Encryption technique. It describes key is randomly generated. Even if cryptanalyst get the message it is hard the decrypt the message because the every time cipher text for same plain text isdifferent. In this technique cipher text is in the form of question marks (70% cipher text is in the form of Question Mark).In future this method can be made more secure y using complex encryption method as well as additional bit generation to confuse the Cryptanalyst and cipher text is in the form of 100% of (?) question mark.

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DEVELOPMENT OF GREEN Ag/Al_2O_3 CATALYST BY MECHANOCHEMICAL METHOD FOR LOW TEMPERATURE H_2-LPG-SCR OF LEAN NOx

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ABSTRACT

Emission regulations for diesel cars are becoming stricter, especially for NOx emissions. Various devices are available for NOx abatement such as NSCR, EGR, SCR, LNT, etc. But none of the methods is equivocally accepted for 100% NOx reduction from diesel exhaust. SCR is a potential method to convert NOx to N_2 by reductant under rich-O_2 diesel exhaust. Different types of catalysts including noble metals, zeolite, spinels, hydrotalcite, metal oxides, etc. are found effective under strict conditions for diverse reductants (NH_3/urea/HC/H_2, etc.) for SCR of NOx. But none of the catalyst-reductant combination came up to be limitation free. Therefore, the present paper aimed to develop a total environmental friendly method to achieve the NOx emission standard for diesel and lean-burn gasoline vehicles at low temperature by combining altogether a novel approach. The approach involves H_2-HC-SCR of lean NOx over nano-size Ag/Al_2O_3 green catalyst using LPG reductant. LPG was chosen a reducing agent as it leads to a strong decrease in the Gibbs free energy values of NO reduction to N_2. The catalysts were characterized by N_2-sorption, XRD, FTIR and SEM. The best catalyst among the prepared catalysts showed 100% NO conversion at 195°C.

Keywords: Ag/Al_2O_3 Catalyst, NO Reduction, Reactive Calcination, LPG Reductant

I. INTRODUCTION

NOx reduction for lean burn engines exhaust after-treatment is currently an intense area of research. Recently, the emission regulations for NOx from diesel light duty vehicles has been fixed at 80mg km^{-1} by the September 2014 Euro-VI regulations as compared to previous 180mg km^{-1} corresponding to 2011 Euro-V regulations (Gill, 2012). Various control techniques are available for NOx abatement such as NSCR, EGR, SCR, LNT, etc. But none of the methods is equivocally accepted for 100% NOx reduction from diesel exhaust. SCR is a potential method to convert NOx to N_2 by reductant under rich-O_2 diesel exhaust. Different types of catalysts including noble metals, zeolite, spinels, hydrotalcite, metal oxides, etc. are found effective under strict conditions for diverse reductants (NH_3/urea/HC/H_2, etc.). Yet, these catalysts have their own specific limitations and are not sufficiently active below 300°C. It is therefore, imperative to develop a new, green and low cost de-NOx catalyst using an apposite reductant effective at low temperature.

Ag/Al_2O_3 is a unique catalyst reported to be highly active in hydrogen assisted hydrocarbon selective catalytic reduction (H_2-HC-SCR) of lean NOx emissions. It is well known that the silver phase, as well as the performance of the catalyst for lean NOx reduction, is sensitive to the method of preparation and amount of silver loading. The recent studies pointed out that silver oxide and metallic silver is favoured as the active phase (Korhonen et al., 2011). Alumina is found to be the support of choice with 2 wt% silver as optimal for wet-impregnated catalysts. However, their lack of activity below 350^{o}C still remains a problem. Selection of an appropriate reductant may act as a good support system with Ag/Al_2O_3 for NO reduction at low temperature.

The potential use of *LPG as reducing* agent is a better alternative to the other reductants as it leads to a strong decrease in the Gibbs free energy values of NO reduction to N_2 than other reductants (PaÃrvulescu et al. 1998) (Table 1).

Table 1. Gibbs free energy at 500K for reduction of NO in the presence of various reductants

Reductant	H_2	CO	NH_3	CH_4	C_3H_8	C_4H_{10}
$-\Delta G_r$ (kJ/mol)	605.8	646.3	367.5	543.9	603.1	557.7

Methods of catalyst preparation are also an important aspect in order to synthesis the desired catalyst and that too economically. Solvent-free mechano-chemical method of catalyst synthesis is an approach to provide cleaner alternatives to the conventional solution-based methods of preparation. Therefore, in the present work, mechano-chemical technique was used to prepare nano-size $2\%Ag/Al_2O_3$ green catalyst using Ag_2O powder in a planetary ball mill, rather than the conventional multistep solvent-based routes. This technique has the potential to provide more sustainable preparative route to catalysts than the conventional multistep solvent-based routes.

Therefore, the present paper aimed to develop a total environmental friendly method to achieve the NOx emission standard for diesel and lean-burn gasoline vehicles at low temperature by combining altogether a novel approach. The approach involves H_2-HC-SCR of lean NOx over nano-size Ag/Al_2O_3 green catalyst using LPG reductant. $2\%Ag/Al_2O_3$ catalyst was prepared by 1) impregnation method (Ag_{IA}) and 2) mechano-chemical method (Ag_{MA}) and both the catalysts were calcined in air at 500^{o}C. Further, the better catalyst was calcined by a novel reactive calcination route at 500^{o}C in a 4.5%CO-air mixture (Prasad and Singh, 2013).

II. EXPERIMENTAL

2.1 Catalyst Preparation

The Ag/Al_2O_3 catalyst containing 2.0 weight % Ag was prepared by wet-impregnation of commercial γ-Al_2O_3 (Alfa Aesar, surface area 255 m^2g^{-1}) with an aqueous solution of $AgNO_3$. $AgNO_3$ was dissolved in distilled water, required amount of this solution was slowly added to γ-Al_2O_3 under vigorous stirring. Excess water was evaporated at 80 °C on a hot plate. The solid mass dried at 110 ^{o}C overnight and calcined at 500 ^{o}C for 1 h.

Ag/Al_2O_3 catalysts were prepared by ball-milling Ag_2O as the Ag precursor. Accurately weighed powder of the Ag precursors (Sigma Aldrich) and 2.00 g of γ-Al_2O_3 (Sigma Aldrich) to obtain a silver loading of 2 wt % were well-mixed by agate mortar and pestle. The resulting physical mixture was placed into a 150 cm^3 grinding jar with

tungsten carbide inside lining. Seven 10-mm-diameter stainless steel grinding balls were used for grinding taking ball: catalyst ratio 10:1 by weight. Milling was performed in a VB ceramic Planetary Ball Mill at a rotation speed of 500 rpm for 15 min. The resulting powders were calcined at either 550 for 2 h in air (Gill, 2012). Further, reactive calcination (RC) method described elsewhere (Prasad and Singh, 2013) in which precursor was calcined in a specific chemically reactive, 4.5% CO-air mixture was also used. The nomenclatures of the catalysts were as follows:

Table 2. Nomenclature of catalysts

Catalyst	Preparation method
Ag_{MR}	Ball-milled/RC
Ag_{MA}	Ball milled/calcined in air
Ag_{IA}	Impregnated/calcined in air

2.2 Characterisation

Textural characterization of the catalyst samples was done by nitrogen adsorption at -196 ^{o}C using Micromeritics ASAP 2020 analyzer. X-ray diffraction (XRD) patterns of the catalysts were collected on 18 kV rotating anode Rigaku powder diffractometer, using CuKα radiation for phase identification of the catalysts. Fourier transform spectroscopy (FTIR) of the prepared catalyst was recorded in the range of 400-4000 cm^{-1} on Shimadzu 8400 FTIR spectrometer with KBr pellets at room temperature. In present study, the surface morphology was determined with FEI Quanta 200 scanning electron microscope (SEM) instrument. An accelerating voltage of 30kV and magnification of 1000X was applied.

2.3 Catalytic Activity Measurement

The experiments were performed in a fixed bed, tubular reactor under the following conditions: 100 mg catalyst diluted to 1ml with alumina; feed gas 60 ml/min, consisted of 500ppm NO, 1000ppm LPG, 10% O_2, 1%H_2, and Ar balance and pressure = 1 atm. The reaction was carried out in the temperature range of ambient to the temperature till 100% NO conversion was attainted. The compositions of inlet and outlet gases were measured with the help of NO analyzer (Technovation, series-89).

III. RESULT AND DISCUSSION

3.1 Textural Characterization

The BET surface areas of various catalysts are summarized in Table 3. The results show that for all Ag catalyst samples, the specific surface areas are in the range from 60-80 m^2/g. The Ag_{MR} catalyst prepared by ball milling and calcined by RC method exhibited the highest surface area, 79.02 m^2/g, indicating a favorable interaction between silver species and the support of γ-Al_2O_3. The mean pore diameter is also quite low for Ag_{MR}, 55 Å as compared to rest of the samples. Adsorption and desorption isotherms of nitrogen show that the catalys samples are mesoporous material (Fig. 1 a,b,c). In mesoporous materials due to larger pores more number of molecules interacts with each other, and they show better catalytic properties (Kyriienko et al., 2013).

Table 3. Textural Characterization of Ag/Al_2O_3 Catalyst

Catalyst	Surface Area (m^2/g)	Pore Volume (cm^3/g)	Aver. pore Diameter (Å)
Ag_{MR}	79.02	0.081	55.46
Ag_{MA}	68.45	0.089	67.90
Ag_{IA}	61.92	0.065	60.65

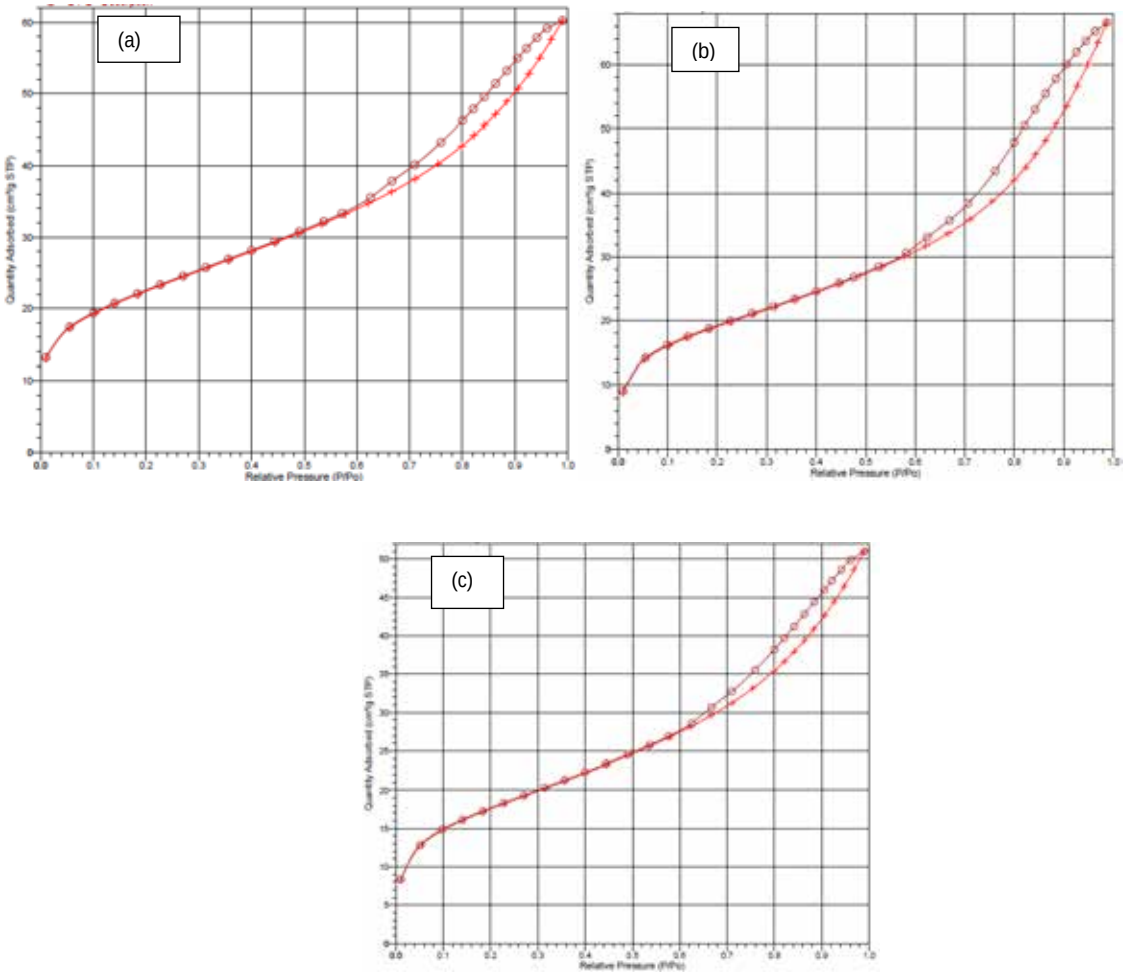

Fig. 1 Adsorption-desorption curve of (a) Ag_{MR} (b) Ag_{MA} (c) Ag_{IA}

3.2 X-Ray Diffraction Analysis (XRD)

XRD pattern of Ag-Al_2O_3 composite are shown in fig. 2. In XRD patterns of the catalysts, much significant, sharper and broad peak of alumina based on peaks at $2\theta \approx 45.8^\circ$ and 67.18 were observed (Zhang et al., 2010). In all the samples weak diffraction lines of metallic silver were found at $2\theta \approx 37.2^\circ$ whereas peaks at $2\theta \approx 38.2, 77.6^\circ$ were present only in samples Ag_{MR} and Ag_{MA}. Additional strong peak at $2\theta \approx 38.1^\circ$ and mild peak at $2\theta \approx 64.5^\circ$ of metallic silver were observed exclusively in Ag_{MR} (JCPDS 04-0783). No silver aluminate lines were detected, this may be due to the small amount of silver and high dispersion. Significant peak at $2\theta = 32.4$ indicates presence of Ag_2O phases in all the samples (JCPDS 41-1104) (She and Flytzani-Stephanopoulos, 2006).

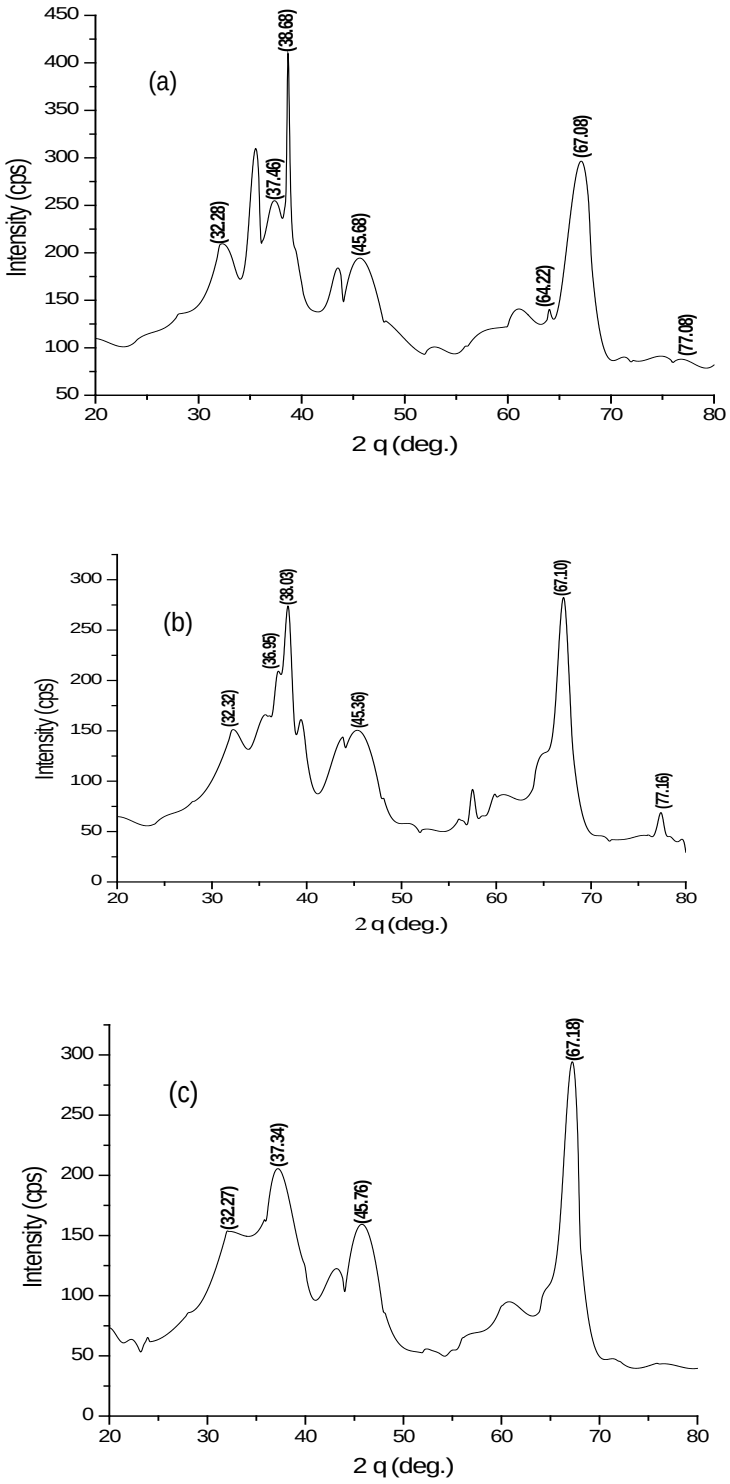

Fig. 2 XRD pattern of (a) Ag_{MR} (b) Ag_{MA} (c) Ag_{IA}

3.3 Fourier Transform Infrared Spectroscopy (FTIR)

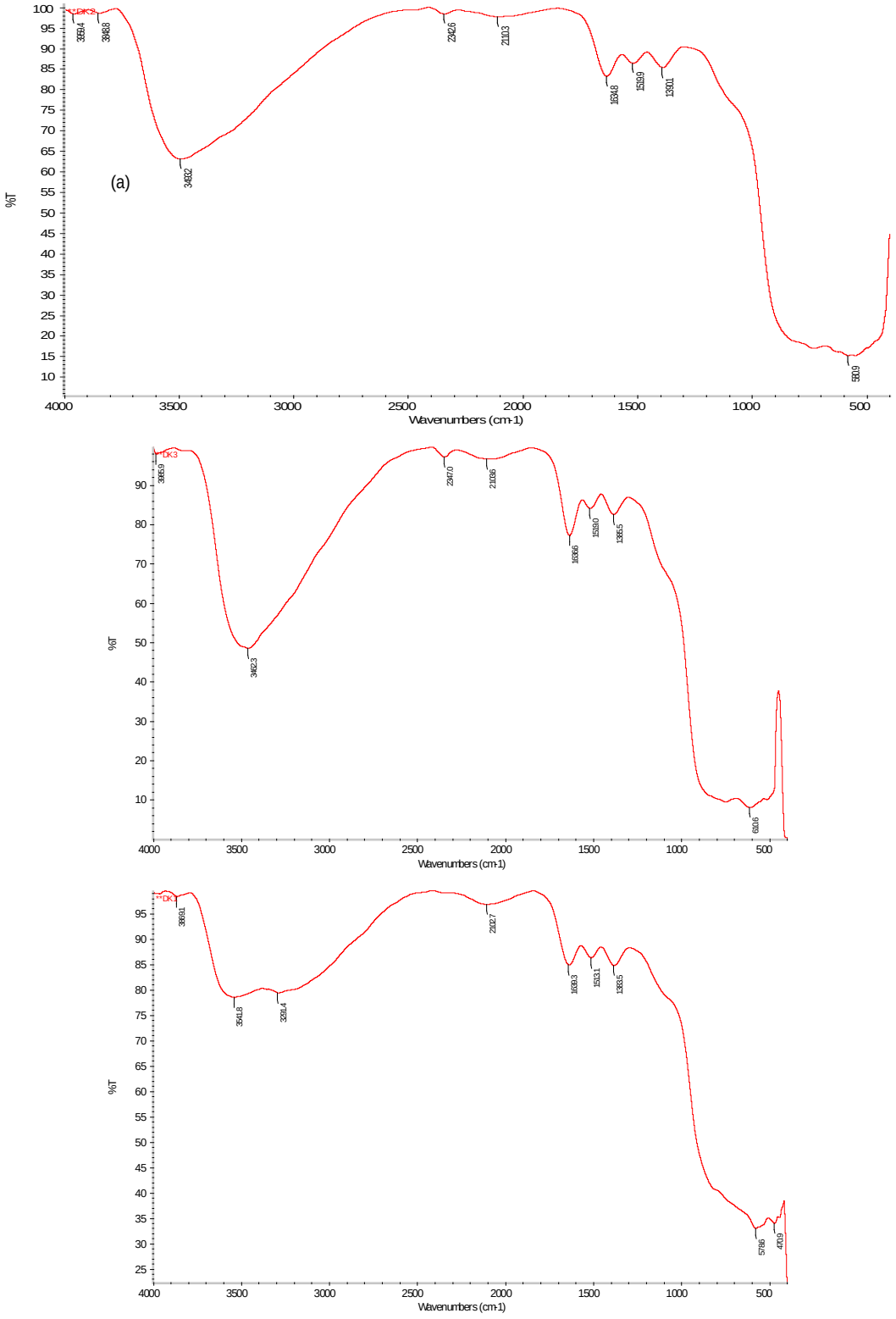

Fig. 3 FTIR spectra of (a) Ag_{MR} (b) Ag_{MA} (c) Ag_{IA}

In the FTIR spectra several peaks appear in the range 3900-3000 cm^{-1} cm^{-1}, which are owing to OH stretching vibrations (Fig. 3 a,b,c). The OH configurations possess different properties as a consequence of their different net charges, and one property that is influenced is the acidity (Sazama et al. 2005). The peak distribution is similar for

all samples investigated. The surface acidity will hence not be the cause for the differences in catalytic performance observed for the different samples.

3.4 Scanning Electron Microscopy (SEM)

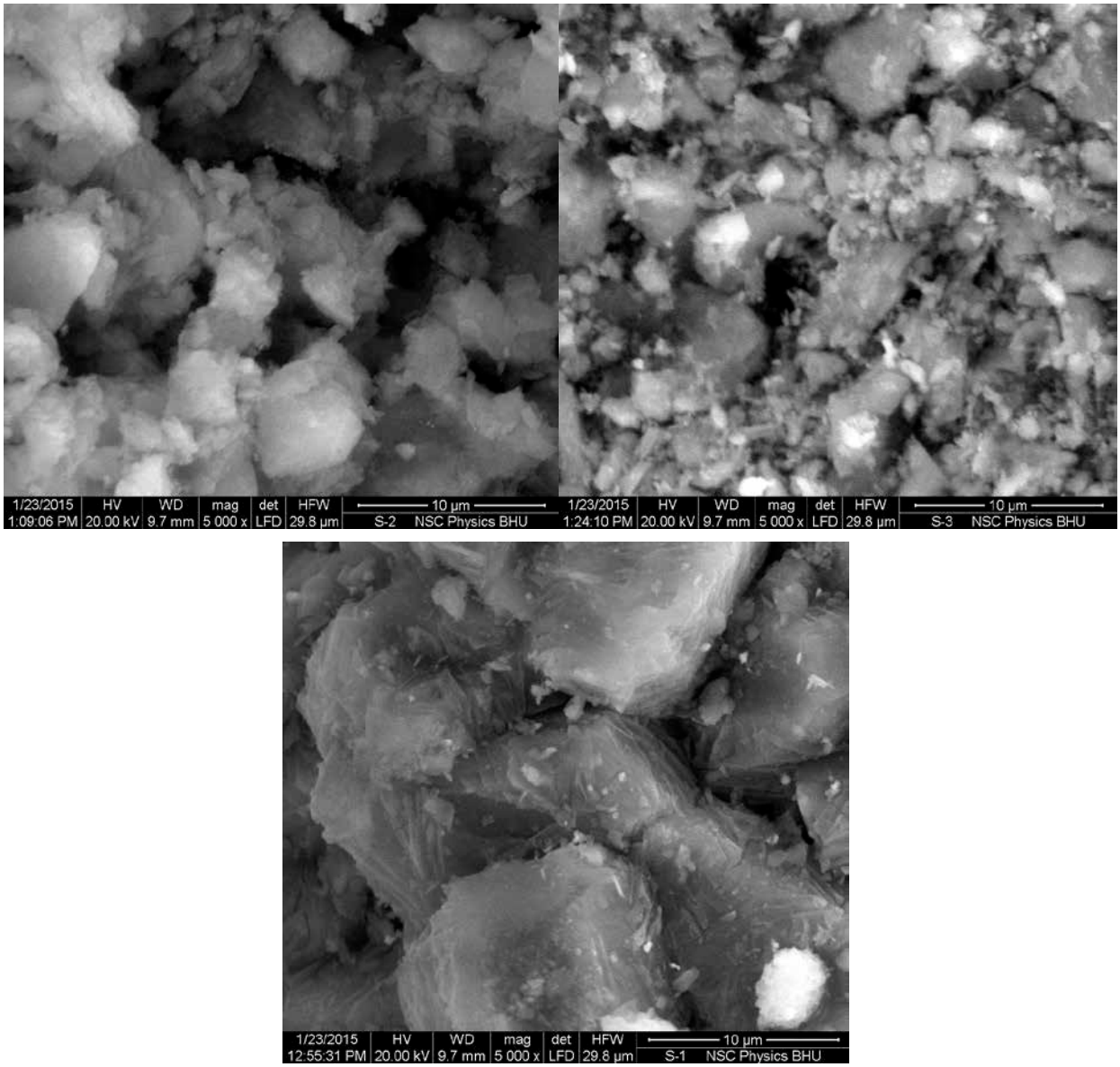

Fig. 4 SEM micrographs of (a) Ag_{MR} (b) Ag_{MA} (c) Ag_{IA}

In SEM micrographs (Fig. 4 a,b,c) it is clearly visible that silver particles are in good contact with the alumina matrix. The silver particles are quite large in the impregnated sample, compared to the ball milled samples. It was also observed that silver particles are visible on the alumina matrix in case of Ag_{IA} (Fig. 4c) whereas it is well

dispersed in ball milled samples, so one can conclude that silver is uniformly distributed over the surface of Al_2O_3 in the Ag_{MR} and Ag_{MA} samples.

3.5 Catalytic Activity Measurement

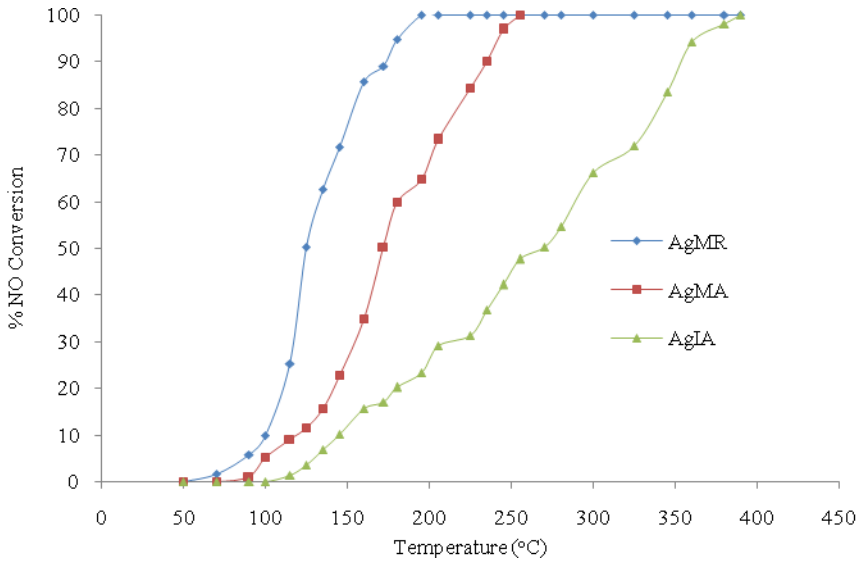

Fig. 5 Temperature Vs NO conversion over Ag/Al_2O_3 catalysts

The ball milled catalyst calcined by reactive calcination denoted by Ag_{MR}, showed the best performance compared to Ag_{MA} and Ag_{IA} (table 4), giving 100% NO conversion at 195°C. The complete NO conversion to N_2 was maintained up to 390°C. The light off temperatures for NO conversion over the catalyst samples are given in table 4.

Table 4. Light off temperatures of NO over Ag/Al_2O_3 catalysts

	T_i (°C)	T_{50} (°C)	T_{100} (°C)
Ag_{MR}	70	125	195
Ag_{MA}	90	172	255
Ag_{IA}	115	270	390

It is observed by many authors [Kamolphop et al. 2011, Korhonen et al., 2011, Ghude et al., 2013] that the NOx reduction is not only connected to an optimized silver loading, but also to the nature of the reductants. The potential use of *LPG as reducing* agent is a better alternative to the other reductants as it leads to a strong decrease in the Gibbs free energy values of NO reduction to N_2 than other reductants. The SCR reaction over $Ag\text{-}Al_2O_3$ catalysts is most likely dependent on two factors: the ability to reduce NOx to N_2 and to activate (partially oxidize) the reducing agent, i.e. the hydrocarbon (Klingstedt, 2009). Metallic silver supported on alumina is active for the combustion of hydrocarbons and oxidation of NO to NO_2 (Koebel et al., 2000), whereas oxidized silver, present in the form of e.g. silver ions, silver aluminate or oxides, is shown to promote the formation of N_2 during HC-SCR conditions.

This implies that samples active for NO*x* reduction most likely contain silver in metallic and oxidized/ionic state, very finely distributed throughout the alumina matrix. Together, the results from the textural characteisation, XRD and SEM analyses suggest that the Ag_{MR} samples contain more non-metallic silver, finely dispersed throughout the alumina matrix compared to the rest of the samples. It is clear that preparation via ball milling combined with reactive calcination facilitates the dispersion of the silver species into the alumina matrix. Whereas, preparation via impregnation results in silver distributed only on the surface of the support, theoretically giving access to all silver deposited on the alumina. However, agglomeration of silver species forming metallic silver reduces the ratio of accessible silver, as the bulk silver does not take part in the HC-SCR reaction. Further, reactive calcination further facilitates dispersion of metal over support, prevents agglomeration of particles as well as preserves active site of the catalyst by averting uncontrolled oxidation.

IV. CONCLUSION

Ag/Al_2O_3 green catalyst has been synthesized by a total environmental friendly approach by planetary ball milling followed by the reactive calcination for the H_2-HC-SCR of lean NOx using LPG as a reductant for the first time. Reactive calcination further helps in improving the activity of the catalyst. As a result of combination of high activity catalyst and apposite reductant, NOx conversion is achieved at low temperature. Therefore, it can be concluded that Ag_{MR} catalyst has the potential to achieve the goal of NOx emission standard from diesel, petrol as well as LPG-fuelled vehicles using H_2-LPG-SCR. It is hoped that the H_2-LPG-SCR using Ag/Al_2O_3 can be considered as a breakthrough NOx control technology in favor of the present Urea-SCR.

V. ACKNOWLEDGMENTS

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DESIGN OF LOW POWER CMOS LOW NOISE AMPLIFIER USING CURRENT REUSE METHOD- A REVIEW

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ABSTRACT

LNA is one of the most important building blocks in the front end of the wireless communication systems. Amplification of weak signal and attenuation in noise level is a key role of LNA. In recent years valuable research is done on CMOS LNA design in on improvement of low power consumption, low noise figure, high gain, smaller space and low supply voltage. This paper illustrates a review work regarding the low power LNA design. The paper describes some fundamentals of LNA, designing method for low power LNA and design steps. This paper will be beneficial for primary stage of CMOS LNA design with low power consumption.

Keywords: Current Reuse Method, Lna, Low Power Consumption

I. INTRODUCTION

Wireless communication system is an integral part of day today communication. For effective wireless communication, faithful trans-reception of the signal is required. It can be achieved by careful design of the receiver circuit. Radio frequency design has been one of the major research areas in these days. Evolution of several Wireless Communication standards has demanded availability of different analog blocks for use in transceivers with different parameters, imposed by the nature of application. Particularly, lot of research has been carried out in CMOS technology, due to its high speed and low cost nature.

Any communication system must require transmitter and receiver for exchange of data or information. The design of wireless receiver is big task as receiver faces various external as well as internal design issues. In wireless receiver low noise amplifier (LNA) is a critical building block that amplifies the received signal and contributes most of the noise figure of whole receiver. LNA is an integral component of RF receiver and mostly required to operate at wideband frequency range. LNA performs various functions i.e. to amplify the signal, reduction of noise, reduce Noise Figure (NF), increase gain, improve stability and eliminate channel interference [1]. But the most important function is to amplify signal with low noise amplification [2,3].

The communication system that consists of transmitter and receiver will face not only attenuation but also the interference at the receiver end [4,5]. The received signal is so weak to use for demodulator so that it is necessary to amplify it with minimum noise amplification. So, LNA is most essential active block in receiver front end chain. LNA is situated between RF filter and mixer as shown in Fig. 1 [1].

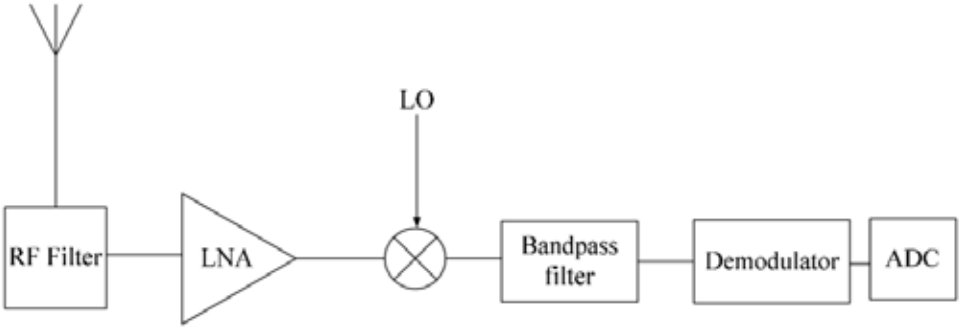

Fig.1: Block diagram of simple receiver front end

The primary challenge in LNA design is to achieve maximum input matching and low noise at any given power. Therefore, many kinds of LNA topologies have been proposed to satisfy the requirements for good performance at low power dissipation [5,6]. From the survey of recent years' works on LNAs, it is concluded that a low power LNA is required while providing high gain, low NF and better linearity. So, a special attention has to be paid to develop low power techniques for CMOS RF circuit.

During literature survey, it is found that Current Reuse Technique is one of the best methods used to design low power high gain LNA. In this paper, chapter II includes brief description of LNA using current reuse method. Design methodology and design steps are included in chapter III. Chapter IV describes design flow of LNA which is followed by conclusion and references.

II. CURRENT REUSE METHOD

The current-reuse topology may provide the best combination of high power gain, low noise figure, and low power consumption, making it a feasible option for use in UWB LNA designs [5]. In an amplifier employing current-reuse techniques, the input RF signal is amplified by two cascaded common-source amplifier stages to provide high gain. At the same time, this topology also supports low noise figures. The input matching circuitry is aided by a high-pass filter to suppress noise [8]. The basic issue with using CMOS transistor for LNA is its inherently low transconductance and hence low gain. However, if current reuse method is used, transconductance would be increased. The key point is that given the same bias current the effective transconductance is $g_{m1} * g_{m2,}$ while it is simply g_m in other cases. That's why due to single source it dissipates low power [5].

The current reused model can be considered as a two stage cascade amplifier, in which the first stage is the CS amplifier and the second stage is the cascode amplifier with an additional buffer stage at output end [8].

The current-reuse technique is well known for its use in LNAs, for its capability of achieving high performance with power consumption that is less than conventional two-stage common-source amplifiers Fig. 2(a). In such a design approach, transistors M_1 and M_2 are connected as a cascade structure by means of coupling capacitor C_1; load inductor L_{load} and load resistor R_{load} are the loads for transistors M_1 and M_2; and currents I_{D1} and I_{D2} are the drain currents for transistors M_1 and M_2. [5,8,9]

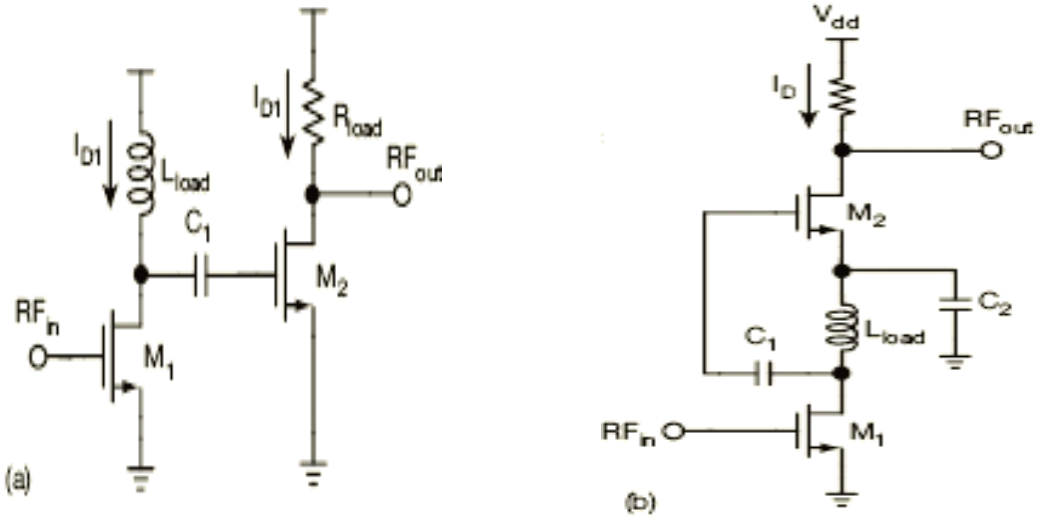

Fig. 2(a): Conventional Two stage CS amplifier, Fig. 2(b): Conventional Current Reuse method

Fig. 2(b) shows the schematic diagram for the two-stage current-reuse common-source amplifier, with C_2 used as a bypass capacitor. It can be seen that currents I_{D1} and I_{D2} can be reused as current I_D; there is just one current path between drain voltage V_{DD} and ground. In the experimental current-reuse LNA, the amplifier topology has been transformed from a two-stage common source structure without changing the essential amplifier type, resulting in high gain without adding power consumption.

Current Reuse topology can be used with any circuit configuration like cascode topology, common source or common gate, and feedback topologies or even with multi stage cascaded structures to reduce the DC power consumption. A major drawback of current reuse method is its high input & output impedances thus, it require external impedance matching [5,10].

III. DESIGN METHODOLOGY

The design methodology for LNA with current reused method is as below [11]:

Step- 1: In Fig. 3 given below, C_{gs} is the parasitic capacitance and L_2 is source degenerated inductor. All other parasitic effects are ignored. So, input impedance is derived by using equation (1):

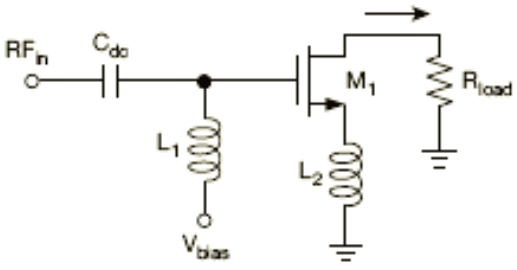

Fig. 3: Input impedance network for current reuse method

$$Z_{in} = \frac{1}{sC_{dc1}} + sL_1 \,||\, (\frac{1}{sC_{gs}} + sL_2 + \frac{g_m}{C_{gs}}) \,||\, R_{Load} \quad \text{..... (1)}$$

Step- 2: The experimental current reuse LNA employs an internal CS configuration with two stages. The voltage gain of CS amplifier can be calculated using equation (2):

$$A_v = g_m(r_0 \,||\, R_L) \quad \text{..... (2)}$$

Where:

r_0 = the output resistance of transistor M_1

R_L = the load resistance.

Step- 3: From Figure 4.1(b), we can obtain equivalent gain circuit as shown in Fig. 4. This circuit is divided into two stages. The Voltage gain of first stage is found by using equation (3):

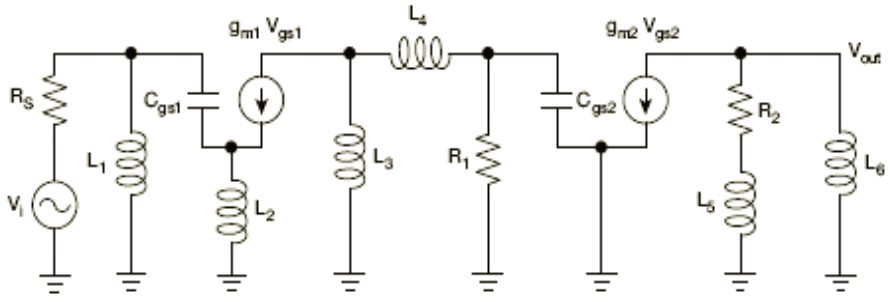

Fig. 4: Equivalent gain circuit of Fig. 2(b)

$$A_{v1} = - g_{m1}.\frac{sL_3 \,||\, (sL_4 + R_1)}{1 + sL_2(g_m + sC_{gs})} \quad \text{..... (3)}$$

Step- 4: The Voltage gain of second stage is calculated by means of equation (4):

$$A_{v2} = - g_{m2}.\{(R_2 + sL_5) \,||\, sL_6\} \quad \text{..... (4)}$$

Step- 5: The Voltage gain of overall circuit is shown in equation (5):

$$A_v = A_{v1}' \; A_{v2}$$

$$A_v = g_{m1}.g_{m2}.\frac{sL_3 \,||\, (sL_4 + R_1)\{R_2 + sL_5 \,||\, sL_6\}}{1 + sL_2(g_m + sC_{gs})} \quad \text{..... (5)}$$

Step- 6: One of the key performance parameters in the design of any LNA is noise figure which, in general, sets the noise figure for the first stage of a receiver. Noise figure is additive in an LNA, depending on the number of stages, with the noise of the first stage having the greatest impact on the overall noise figure of a multistage amplifier. The total noise figure of a multistage LNA circuit configuration, F_{total}, can be found from equation (6):

$$F_{Total} = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1.G_2} + \ldots \quad \text{..... (6)}$$

Where:

F_1 = the noise figure of the amplifier's first stage and

G_1= its gain

IV. DESIGN FLOW

The design procedure is depicted in Fig. 5. The design process starts with the calculation of transistor size. Then after, we will calculate the values of all components like resistors, capacitors and inductors. After calculation, optimization is applied; if we don't get desired results then whole process is repeated using iteration.

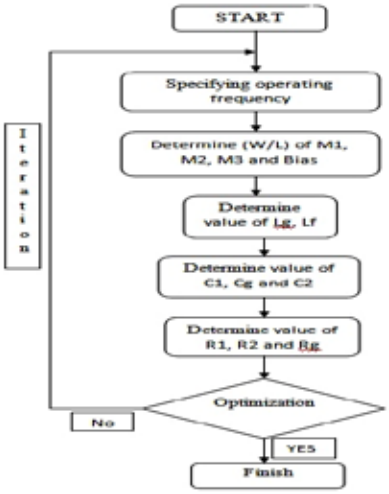

Fig. 5: Design flow diagram

V. CONCLUSION

This paper presents the theory of low power CMOS LNA design. During the survey, it is found that current reuse method is one of the best methods used to design low power LNA. Current reuse method is described here with simple design methodology. As per the recent scenario low power consumption is big task to every electronics device. So, this paper will be guide in the direction of low power design of LNA.

VI. ACKNOWLEDGEMENT

I extend my sincere thanks to Prof. Kehul Shah for providing me the right guidance as well as for their support, encouragement and facilities in completing this work.

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TOPOLOGICAL PROPERTIESOF TWO DIMENSIONAL FRACTIONAL FOURIER-MELLIN TRANSFORM

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ABSTRACT

Integral transforms play wide and important role in mathematical physics, theoretical physics. Fourier and Mellin transform has many applications such as signal processing, algorithm, watermarking, pattern recognition, correlators, navigation, vowel recognition, cryptographic scheme, quantum calculus, radar system and have applications in agriculture, medical stream.

In this paper topological properties are proved for two dimensional fractional Fourier-Mellin transform.

Keywords: Fourier- Mellin Transform, Two-Dimensional Fractional Fourier-Mellin Transform, Testing Function Space, generalized function

I. INTRODUCTION

In the literature there are numerous integral transforms and widely used in physics,astronomy as well as in engineering. In order to solve the differential equations, the integraltransform were extensively used and thus there are several works on the theory andapplication of integral transform such as the Laplace, Fourier, Mellin, and Hankel, to namebut a few [1].The Fourier transform is no longer the appropriate transform tochange the representation space of these signals. It has to be replaced by a new transform, the Mellin transform, which is invariant in modulus to dilations anddecomposes the signal on a basis of hyperbolic signals.. In signal processing terms, the MI of a sound is the Mellin transform of a stabilized wavelet transform of the sound. Toshio Irino a, Roy D. Patterson discussed in their article that the MI provides a good model of auditory vowel normalization, and that this provides a good framework for auditory processing from cochlea to cortex [3].Fourier transform and Mellin transform provide us alternative ways to analyze the spectra of different signals. Mellin transform, a kind of nonlinear transformation, is widely used for its scale invariance property. Perhaps the most famous application is the computation of the solution to a potential problem in a wedge-shaped region, where the unknown function is supposed to satisfy Laplace's equation with given boundary conditions on the edges [6].A further development in the used of the Fourier-Mellin transform is its application into the radar classification of ships by Zwicke etal . Fourier-Mellin transform provides a global method for registering images in a video sequence from which the rotation and translation of the camera motion can be estimated. It has been ability of the gray level image representation for pattern recognition. FMT is used to identify plant

leaves at various life stages based on the leaves shape or contour [2].Kin etal [4] had also described awatermarked method for the protection of multimedia signals (image, sound) in which Fourier-Mellin transform is used as a tool. A further development in the use of the Fourier-Mellin transform is its application into the radar classification of ships by Zwicke etal [5]. Fourier-Mellin transform is used to identify plant leaves at variouslife stages based on the leaves shape or contour [7]. Fourier-Mellin transform is also used in estimation of optical flow [6].

DEFINITIONS

1.1 Two Dimensional Fractional Fourier-Mellin Transform

The two dimensional fractional Fourier-Mellin transform with parameter α & θ of $f(x,y,u,v)$ denoted by $2DFRFMT\{f(x,y,u,v)\}$ performs a linear operation, given by the integral transform

$$2DFRFMT\{f(x,y,u,v)\} = F_{\alpha,\beta}(p,q,r,s) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{0}^{\infty}\int_{0}^{\infty} f(x,y,u,v)K_{\alpha,\beta}(x,y,u,v,p,q,r,s)\,dxdydudv$$

where,

$$K_{\alpha,\beta}(x,y,u,v,p,q,r,s) = \sqrt{\frac{1-i\cot\alpha}{2\pi}}\, e^{\frac{i}{2\sin\alpha}[x^2+y^2+u^2+v^2)\cos\alpha - 2(xp+yq)}\, u^{\frac{2\pi ir}{\sin\theta}-1}\, v^{\frac{2\pi is}{\sin\theta}-1}\, e^{\frac{\pi i}{\tan\theta}[r^2+s^2+\log u^2+\log v^2]}$$

where, $0 < \alpha < \frac{\pi}{2}, 0 < \theta < \frac{\pi}{2}$.

1.2 Distributional Two Dimensional Fractional Fourier-Mellin Transform (2DFRFMT)

The two dimensional fractional Fourier-Mellin transform

$$f(x,y,u,v) = F_{\alpha,\beta}(p,q,r,s) = (f(x,y,u,v), K_{\alpha,\beta}(x,y,u,v,p,q,r,s))$$

$$K_{\alpha,\beta}(x,y,u,v,p,q,r,s) = \sqrt{\frac{1-i\cot\alpha}{2\pi}}\, e^{\frac{i}{2\sin\alpha}[x^2+y^2+u^2+v^2)\cos\alpha - 2(xp+yq)}\, u^{\frac{2\pi ir}{\sin\theta}-1}\, v^{\frac{2\pi is}{\sin\theta}-1}\, e^{\frac{\pi i}{\tan\theta}[r^2+s^2+\log u^2+\log v^2]}$$

where, $0 < \alpha < \frac{\pi}{2}, 0 < \theta < \frac{\pi}{2}$.

In the present work topological properties for two dimensional fractional Fourier-Mellin transform are proved.

II. THEOREM

2.1 ($2DFRF\,M_\alpha, T_\alpha$) is a Frechet space.

Proof:- As the family of D_α of seminorms $\{\gamma_{E,p,q,r,s}\}_{p,q,r,s=0}^{\infty}$ generating T_α is countable, it suffices to completeness of the space $(2DFRF\,M_\alpha, T_\alpha)$.

Let us consider a Cauchy sequence $\{\emptyset_n\}$in $2DFRF\,M_\alpha$.

Hence for a given $\epsilon > 0$, there exist a $N = N_{p,q,r,s}$ such that for $m,n \geq N$.

$$\gamma_{E,p,q,r,s}(\emptyset_m - \emptyset_n) = \sup_{I_1} \left|x^k y^l D_{x,y}^{p,q} D_{u,v}^{r,s}[\emptyset_m(x,y,u,v) - \emptyset_n(x,y,u,v)]\right| \leq \epsilon \qquad (1)$$

In particular for $k = l = 0$, for $m,n \geq N$

$$\sup_{I_1} |\emptyset_m(x,y,u,v) - \emptyset_n(x,y,u,v)| < \epsilon \qquad (2)$$

Consequently for fixed (x,y,u,v)in I_1, $\{\emptyset_m(x,y,u,v)\}$ is a numerically Cauchy sequence.

Let, $\emptyset(x,y,u,v)$ be the point wise limit of $\{\emptyset_m(x,y,u,v)\}$.

Using (2) we can easily deducted that $\{\emptyset_m\}$ converges to $\emptyset$ uniformly on I_1. Thus $\emptyset$ is continuous.

Moreover repeated use of (1) for different values of p, q, r, s yields that $\emptyset$ is smooth i.e. $\emptyset \epsilon E_+$.

Further from (1) we get

$$\gamma_{E,p,q,r,s}(\emptyset_m) \leq \gamma_{E,p,q,r,s}(\emptyset_N) + \epsilon, m \geq N$$

$$\leq C_{p,q,r,s} A^k k^{k\alpha} B^l l^{l\alpha} + \epsilon$$

Taking $m \to \infty$ and ϵ is arbitrary we get

$$\gamma_{E,p,q,r,s}[\emptyset] = \sup_{I_1} \left| x^k y^l D_{x,y}^{p,q} D_{u,v}^{r,s} \emptyset(x,y,u,v) \right|$$

$$\leq C_{p,q,r,s} A^k k^{k\alpha} B^l l^{l\alpha}$$

and it is the T_α limit of $\emptyset_m$

Hence $\emptyset \epsilon 2DFRFM_\alpha$

This proves completeness of $2DFRFM_\alpha$.

2.2. The space $\mathcal{D}(I)_1$ is subspace of $2DFRFM_\alpha$.

Proof: For $\emptyset(x,y,u,v) \epsilon \mathcal{D}(I)_1$

Set, $L = \sup_{I_1} |x : (x,y,u,v) \epsilon \, supp \emptyset|$

$$Q = \sup_{I_1} |y : (x,y,u,v) \epsilon \, supp \emptyset|$$

$$C_{p,q,r,s} = \sup_{I_1} \left| D_{x,y}^{p,q} D_{u,v}^{r,s} \emptyset(x,y,u,v) \right|$$

Then

$$\gamma_{E,p,q,r,s}[\emptyset(x,y,u,v)] = \sup_{I_1} \left| x^k y^l D_{x,y}^{p,q} D_{u,v}^{r,s} \emptyset(x,y,u,v) \right| \leq C_{p,q,r,s} L^k Q^l = C_{p,q,r,s} L^k Q^l \frac{k^{k\alpha}}{k^{k\alpha}} \frac{l^{l\alpha}}{l^{l\alpha}} \frac{A^k}{A^k} \frac{B^l}{B^l}$$

$$= C_{p,q,r,s} \left(\frac{L}{Ak^\alpha} \right)^k \left(\frac{Q}{Bl^\alpha} \right)^l A^k B^l k^{k\alpha} l^{l\alpha} \qquad (3)$$

Since $\left(\frac{L}{Ak^\alpha} \right) \leq 1$, $\left(\frac{Q}{Bl^\alpha} \right) \leq 1$

iff $k \geq \left(\frac{L}{A} \right)^{1/\alpha}$, $l \geq \left(\frac{Q}{B} \right)^{1/\alpha}$

define $k_0 = \left\{ \left[\frac{L}{A} \right]^{1/\alpha} + 1 \right\}$, $l_0 = \left\{ \left[\frac{Q}{B} \right]^{1/\alpha} + 1 \right\}$

where, [t] denotes the Gaussian symbol that is the greatest integer not exceeding t.

therefore, for $k > k_0$, $l > l_0$ we have

$$\gamma_{E,p,q,r,s}[\emptyset(x,y,u,v)] \leq C_{p,q,r,s} A^k k^{k\alpha} B^l l^{l\alpha} \qquad (4)$$

Now if $k \leq k_0$, $l \leq l_0$

$$C_1 = max \left\{ \left(\frac{L}{A} \right), \left(\frac{L}{A2^\alpha} \right)^2, \left(\frac{L}{A3^\alpha} \right)^3 ------ \left(\frac{L}{Ak^\alpha} \right)^{k_0} \right\}$$

$$C_2 = max \left\{ \left(\frac{Q}{B} \right), \left(\frac{Q}{B2^\alpha} \right)^2, \left(\frac{Q}{B3^\alpha} \right)^3 ------ \left(\frac{Q}{Bk^\alpha} \right)^{l_0} \right\}$$

Then again from (3) we get,

$$\gamma_{E,p,q,r,s}[\emptyset(x,y,u,v)] \leq C_{p,q,r,s} C_1 C_2 A^k k^{k\alpha} B^l l^{l\alpha} \qquad (5)$$

Hence (4) (5) gives inequalities

$\leq C'_{p,q,r,s} A^k k^{k\alpha} B^l l^{l\alpha} \forall k \geq 0, \quad l \geq 0$ where $C'_{p,q,r,s} = C_{p,q,r,s} C_1 C_2$

This gives $\emptyset(x, y, u, v) \epsilon 2DFRFM$

$\mathcal{D}(I)_1 \subset 2DFRF\, M_\alpha$

III. CONCLUSION

In thispaper topological properties for two dimensional fractional Fourier-Mellin transform are proved.

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