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THE HEAT TRANSFER ENHANCEMENT TECHNIQUES –A REVIEW

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ABSRACT

Today's many new techniques got to be compelled for the developments of recent thermal devices for dissipating high heat flux for guarantee stable and optimum operation. in steam power plants, thermal processes concerned in pharmaceutical and chemical industries, sensible heating and cooling of milk in dairy farm industries, heating of fluid in focused reflector and cooling of electrical machines and electronic devices, rough surfaces or extended surfaces are used for the aim of accelerating the effective surface area whereas inserts, winglets, tabulators etc. are used for generating the turbulence. the foremost aim of this work is to review varied researches tired past to spice up heat transfer rate and hydraulic behavior of heat pipe with inserts by either dynamic its geometry, climate condition and material, Geometrical parameters of inserts like breadth, length, twist magnitude relation,etc.

Keywords-Heat Transfer, Heat Pipe, Twisted tape, Artificial Roughness.

I INTRODUCTION

Conversion and recovery of heat in several industrial and domestic applications heat transfer devices are used. Some examples area unit boiling of liquid and condensation of steam in power plants, thermal processes concerned in pharmaceutical and chemical industries, sensible heating and cooling of milk in dairy farm industries, heating of fluid in targeted solar furnace and cooling of electrical machines and electronic devices among others therefore on improve the potency of energy transfer and to minimize the environmental impact., heat pipes are utilized as high-efficiency heat transfer components in heat recovery applications additionally rough surfaces or extended surfaces are used for the aim of accelerating the effective area whereas inserts, winglets, tabulators etc. are used for generating the turbulence. These changes are sometimes in the midst of a rise in pumping power which may leads to higher cost.Heat transfer enrichment inside heat pipe is also very important for optimize the thermal performance of heat exchange devices. It is usually achieved by generating some rotationalmotions in the moving fluid.

II LITERATURE REVIEW

Some of the vital paper associated with analysis for enhancement of heat transfers are reviewed and mentioned here.

Anas El Maakoulet. al (2017) [1] they have investigated numerically the design and thermo-hydraulic performance of a double pipe device with helical baffles within the annulus side with the assistance of using the software FLUENT, and based the result for helically baffled annulus sides offer increased heat transfer performance and high-pressure drop compared to the simple double-pipe exchangers. Thermal performance and high-pressure drop is an increasing operates of baffle spacing and Re.

Z. Deng et al (2017) [2] they have investigated numerically the thermal performance of a pulsating heat pipe (PHP) below anti-gravity operation. The operating fluid within the PHP is methanol and therefore the Bond variety of those experiments ranges from zero.833 to 1.068. The experimental results indicate that an anti-gravity PHP forever experiences an extended start-up method, exhibits more intense quasi-steady temperature oscillations and includes a larger thermal resistance, implying that gravity plays a very important positive role within the thermal performance of the PHP.

ZhenfeiFeng et al (2017) [3] they have done a numerical investigation to check the laminar liquid flow and coupled heat transfer performance in rectangular small channel conductor (MCHS) equipped with wire coil inserts. The results show that the heat transfer performance within the MCHS is increased effectively because of the longitudinal vortexes caused by the wire coils; however the flow resistance is enlarged at the same time. The MCHS with long wire coil placed at the middle line of small channel shows the simplest heat transfer performance with improvement factor of 1.4-1.8 at a heat flux 400 kW/m2. It’s additionally founded that the most effective overall performance using PEC at the high Reynolds is the MCHS with 3 segments of short wire coils placed at the middle line of small channel.

SompolSkullong et al. (2016) [4] they have investigated by experimentation on thermal performance improvement in a solar air heater channel with combined wavy-groove and delta-wing vortex generator (WVG) placed on the absorbent plate having a consistent wall heat-flux below the range of Reynolds number from 4800 to 23,000. The result discovered that at g/H=0.5, the smaller Ah/Aw provides the highest Nusselt number and friction factor around 6 and 30 times over the smooth channel severally however the optimum thermal performance is at Ah/Aw=0.085 and g/H=0.5.

ChaitanyaVashistha, et al. (2016) [5] they have investigated that the heat transfer and fluid flow characteristics of a circular tube fitted with multiple inserts organized in co-swirl and counter-swirl orientations at Reynolds number range of 4000 to 14000 and based that the most improvement within the heat transfer and friction are found to be

2.42 and 6.96 times that of smooth tube whereas the maximum value of the thermo-hydraulic performance factor is found to be 1.26 for a group of four counter-swirl twisted tapes with the twist ratio of 2.5.

WeiguoXuet al. (2016) [6] they have conducted the experiments and numerical simulations on heat transfer coefficient and friction factor of Therminol 55 liquid phase heat transfer fluid in a ribbed tube with outer diameter and inner diameter of 19.0 and 15.0 mm, and pitch and rib height of 4.5 and 1.0 mm, respectively. Experimental results show that the heat transfer and thermal performance of Therminol 55 liquid part heat transfer fluid within the ribbed tube area unit considerably improved compared to those of the smooth tube once the Reynolds variety ranges from 500 to 11,500 and it's additionally determined from the numerical results that the ribbed tube will improve heat transfer and fluid flow performances of Therminol liquid phase heat transfer fluid.

NianbenZheng, et al. (2016) [7] they have numerically investigated the consequences of rib arrangements on the flow pattern and heat transfer in an internally ribbed device tube. Details of the flow structures within the tube with parallel type ribs (P-type ribs) and V shape type ribs (V-type ribs) severally. The results reveal that rib arrangements have perceptible effects upon the flow pattern and heat transfer within the ribbed tube. the common Nusselt variety and friction factor the V-type ribbed tubes were about 57e76% and 86e94% over those within the P-type ribbed tube, respectively.

F. Hormozi et al (2016) [8] they have been by experimentation studied in a very turbinate coil device for the consequences of surfactants on the thermal performance of the hybrid Nano fluid (Alumina–Silver) at constant wall temperature and streamline flow and ascertained that the thermal performance will be maximized by using the 0.2 vol. the worries hybrids Nano fluid and 0.1 wt. the worries SDS anionic surfactant within the helical coil. the maximum thermal performance within the presence of hybrid Alumina–Silver Nano fluid and SDS anionic surfactant is 16 pf over that of the pure water.

MortezaKhoshvaght-Aliabadi et al (2016) [9] they have investigate the consequences of the cross section form with totally different twist pitch to channel length ratios in twisted mini channel (TMC). The result shows that all the tested TMCs have higher heat transfer coefficient and pressure drop than the smooth circular mini channel. It’s additionally found that the TMC with the half circular cross section has the very best values of the considered PEC for air flow, whereas for liquid operating fluids the very best values are obtained for the TMC with the square cross section.

Zhi-Min Maya Lin et al (2016) [10] they have analyzed numerically for thermo hydraulic performance of a recently designed twisted tape having parallelogram winglet VGs (PWVGs) inserting in a very circular tube under uniform wall temperature condition, and four different attack angle (= 27.64°, 21.44°, 17.44° and 14.67°) and four totally different axial spacing St (St = 0.83D, 1.0D, 1.25D and 1.67D). The results show that the recently designed twisted tape has 2 ways in which to get secondary flow, including secondary flow generated by the twisted base tape and additional secondary flow generated by PWVGs

Hamed Sadighi Dizaji et al (2015) [11] they have been experimentally investigated Heat transfer, pressure drop and effectiveness in a very double pipe device fabricated from corrugated outer and inner tubes. Each of the inner and outer tubes were corrugated by means that of a special machine below the range of reynolds number from 3500 - 18,000 and discovered that the outer tube corrugations and arrangement type of corrugated tubes have significant impact on thermal and resistance characteristics. most effectiveness was obtained for heat exchanger fabricated from concavo-convex corrugated outer tube and convex corrugated inner tube.

Pengxiao Li et al (2015) [12] they have numerically investigated the thermal performance of new insert tube, named centrally hollow narrow twisted tape, of a tube below streamline flow conditions and based that the tube with cross hollow twisted tape inserts has the most effective overall heat transfer performance for different hollow widths of the tape. Compared with the conventional twisted tape, the optimum overall heat transfer performance of the new type of tape will increase by 28.1%. Clearance, that is outlined because the dimension between the tube and twisted tape, conjointly affects the heat transfer performance.

X.P. Liu et al (2015) [13] they have done investigated numerically the geometric impact on thermo hydraulic characteristics of a periodic cross-corrugated channel for the Re range of 200–3000and based that the Apex angle strongly influence the heat transfer and pressure loss in a triangular cross-sectional corrugated channel. For the aim of heat transfer enhancement, cross-corrugated triangular channels at the 90 and 120 Apex angles are recommended. For this flow regime, the cross-corrugated triangular duct with the Apex angle of 150 is shown to be the optimum alternative over all the studied channels. The JF factor is increased by 4.1–7.0 times that in a triangular channel with Apex angle of 90.

N. Piriyarungrod1, et al (2015) [14] they have investigated experimentally the thermal performance characteristics of inserted tapered twisted tapes, below four different taper angles at each taper angle, the tapered twisted tapes were twisted at 3 different twist ratios (y/W) of 3.5, 4.0 and 4.5 under turbulent flow regime for Reynolds numbers between 6000 and 20,000 and based that the heat transfer improvement and friction loss increased with decreasing taper angle and twist magnitude relation and it's also discovered that the Thermal performance factor attended increase with increasing taper angle and decreasing tape twist ratio.

PongjetPromvonge (2015) [15] they have investigated through an experiment the heat transfer augmentation in a very square duct with insertion of combined 30 V-fins and quadruple counter-twisted tapes below uniform wall heat-flux condition with Reynolds number starting from 4000 to 30,000. The experimental results reveal that the warmth transfer and pressure come by the shape of various Nusselt number and friction factor from the V-finned counter-twisted tape tend to extend with the increase of rb however show the reversing trend with increasing RP and conjointly determined that the thermal performance of the V-finned counter-twisted tape is significantly beyond that of the quadruple twisted tapes alone.

Yu Rao et al (2015) [16] they have conducted comparative experimental and numerical study to analyze the heat transfer of flow in channels with one dimpled wall with arrays of spherical dimples and teardrop dimples, and therefore the dimples have identical depth with depth-to-diameter ratio of 0.2 and based that the globally averaged heat transfer enhancement of the spherical dimple channel are often 1.5–1.7 times the absolutely developed flow in a very smooth duct with the friction factor of 1.2–2.0 times the smooth duct flow. Compared to the spherical dimples, the teardrop dimples have distinctively higher heat transfer performance by about 18.0% with increased pressure loss by 35–15% because the Reynolds number increases.

Jung-Yang San (2015) [17] they have investigated the heat transfer and pressure drop information for air flow and water flow in smooth tubes with inserts coiled-wire. The wire diameter-to-tube inner diameter ratio (e/d) and coil pitch-to-tube inner diameter ratio (p/d) are within the ranges of 0.0725 to 0.134 and 1.304 to 2.319 respectively and it's found that the Nusselt number (Nu) increases with the e/d value, whereas it increases with a decrease of the p/d value and it's conjointly revealed that the dependence of the heat transfer improvement of the wire coil on the reynolds number (Re) is minor with air because the operating fluid and therefore the heat transfer improvement significantly decreases with a rise of the Re value with water as an operating fluid.

FarhadSangtarash, (2015) [18] they have developed the numerical and experimental model to analyze the impact of adding an in-line and staggered arrangement of dimples and perforated dimples to multi louvered fins on the heat transfer augmentation and therefore the pressure drop of the air flow through a multi louvered fin bank and based that the adding dimples on the louver surface increases the j factor and therefore the f factor. Likewise, adding perforation to the dimples leads to the same increase. The current results indicate that compared with the inline arrangement, the staggered arrangement might effectively enhance the heat transfer performance.

M.M. Sarafraz et al. (2015) [19] they have investigated through an experiment on forced convective heat transfer coefficient of a biologically made Nano fluid (Green tea leaves and silver nitrate with ethylene–glycol/water as base fluid) flowing in a circular tube within a heat exchanger and revealed that a motivating improvement of heat transfer coefficient up to 67 at vol. % = 1.

M.A. Ahmed et al (2014) [20] they have numerically investigated, laminar flow and heat transfer characteristics of CuO–water Nano fluid in straight and corrugated channels over the Reynolds number and Nano particles volume fraction ranges of 100–800 and 0–0.05, respectively. Results show that the common Nusselt number and thermal–hydraulic performance factor increases with increasing an o particles volume fraction and Reynolds number for all channel shapes .In addition, the non-dimensional pressure drop increases with increasing Nano particles volume fraction, whereas it decreases as Reynolds number increases for all channel geometries. Moreover, the trapezoidal channel has the very best Nusselt number and followed by the sinusoidal, triangular and straight channel.

M.A. Akhavan-Behabadi et al (2014) [21] they have been carried out experimental heat transfer studies during evaporation of R-134 an inside a corrugated tube for seven different tube inclinations, α, during a range of −90° to +90° and four mass velocities of 46, 81, 110 and 136 kg m−2 s−1 for each tube inclination angle during evaporation of R-134a. data analysis demonstrate that the tube inclination angle, α, affects the boiling heat transfer coefficient in a significant manner. The impact of tube inclination angle, α, on heat transfer coefficient, h, is more prominent at low vapor quality and mass velocity. Within the low vapor quality region, the heat transfer coefficient, h, for the +90° inclined tube is concerning 62 more than that of the −90° inclined tube. The results conjointly showed that at all mass velocities, the highest average heat transfer coefficient were achieved for α = +90°.

TabishAlam et al (2014) [22] they have experimentally investigated, the impact of geometrical parameters of the v-shaped perforated blocks on heat transfer and flow characteristics of rectangular duct. for the range of reynolds number from 2000 to 20,000 and based that the maximum improvement in Nusselt and friction factor has been found to be 6.76 and 28.84 times to that of smooth duct, respectively.

III CONCLUSION

This is ascertained from literature survey that heat transfer management is extremely necessary parameter for cooling the equipment, stationary engines and plenty of engineering application, for the economical operating and additionally avoid the heating drawback, therefore we tend to wants the optimized design of heat pipe that is employed as associate extra surface area and providing the massive heat transfer expanse with minimum material and most heat transfer rate. There are several researches in literature created to review for enhancement of heat transfer and founded that the reduction in the flow cross section area, an increase in turbulence intensity and an increase in tangential flow established by various types of inserts.

Geometrical parameters of inserts like width, length, twist ratio, etc. affect the heat transfer enhancement considerably also they have founded that:-

- Heat pipe with inserts offer the higher performance in heat transfer as compared to the blank heat pipe.
- Staggered arrangement of fins offer the most effective result compared to different configuration.
- Spherical dimples, the teardrop dimples have distinctively higher heat transfer performance
- Helically baffled annulus sides provide enhanced heat transfer performance and high-pressure drop compared to the simple double-pipe exchangers.

- Twisted Mini Channels have higher heat transfer coefficient and pressure drop than the smooth circular mini channel.
- Thermal performance of the V-finned counter-twisted tape is considerably higher than that of the quadruple twisted tapes

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