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Commentary

Fluid Dynamics Characterization in Heat Exchangers Process

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DESCRIPTION

Human society has been controlled by energy for ages, but the energy supply is constantly depleting owing to the fast rise of the world population. The global energy consumption is expected to increase by around 80% by 2050. Energy Systems Integration (ESI) is a potential solution that involves collaborating across several energy systems to produce cost-effective energy with minimal environmental impact. The key to implementing the ESI idea is waste heat recovery in industrial operations. The various ranges of waste heat in industrial operations. The low temperature range of 100°C-200°C contains the greatest share of industrial process waste heat.

Several efforts have been devoted to utilize and develop heat exchangers. Heat exchangers were used in a boiler waste heat recovery system. Two case studies of twin spray towers and enthalpy wheel systems were explored in their study. The enthalpy wheel case achieved around 88.4% overall heat efficiency, according to the data. Despite their benefits, traditional heat exchangers have several drawbacks. The size of the heat exchanger has a large impact on heat exchange performance. The performance of conventional and micro channel heat exchangers was compared. According to their findings, the micro channel design might cut mass by 26% and volume by 60%. The heat transfer performance of the micro channel heat exchanger was improved as well as its size.

Evaluating new process improvements to increase the amount of heat recovered from waste heat should be considered. Many advantages of micro channel design that can improve heat transmission and provide an economically viable solution. Additionally, the existing working fluid used as a coolant in a heat exchanger has limited thermal conductivity, which limits the amount of heat that can be transferred. In this field, the addition of solid particles with a diameter of a few nanometers is intriguing since these results in fluid with greater thermal conductivity. This innovative concept, termed as "Nano fluid" is designed to enhance the efficiency of fluid heat transfer. The efficiency of the micro channel heat exchanger in terms of flow and heat transfer. The Nusselt number is a measure of how effectively better a Nano fluid as a coolant transfers heat than pure water. The adequate necessary energy is measured by the Fanning friction factor. Finally, thermal-hydraulic performance will be employed to balance the increased heat transfer from the Nano fluid with the extra power needed.

Applications of Nano fluids in heat exchangers

- The basic fluid's capacity to transmit heat is improved by Nano fluid. Due to their greater heat capacity from the hot fluid source, nanoparticle concentration affects heat transmission, and the enhancement is boosted when employing high concentrations.
- The improvement of heat transfer from Nano fluid while using an excessive Nano fluid concentration will require greater pumping power and appears to dominate.
- Along with the increased pumping power needed due to the increased fanning friction factor, the system trades off with the improvement in heat transfer as well. In all of the outcomes for Nano fluids, the Fanning friction factor increased.
- Since all Nano fluids have a viscosity impact, the weight concentration of Nano fluids tends to grow along with the need for more pumping power.
- A relevant measure that illustrates the initial behaviour of the base-fluid improvement from Nusselt number and fanning friction factor terms is thermal-hydraulic performance.
- This relationship between the Nusselt number and the Fanning friction factor may clearly show how heat transmission has improved and how the pumping power of Nano fluids has increased.

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