Modeling of shell and tube heat recovery exchanger operated with nanofluid based coolants

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Abstract

The emergence of several challenging issues such as climate change, fuel price hike and fuel security have become hot topics around the world. Therefore, introducing highly efficient devices and heat recovery systems are necessary to overcome these challenges. It is reported that a high portion of industrial energy is wasted as flue gas from heating plants, boilers, etc. This study has focused on the application of nanofluids as working fluids in shell and tube heat recovery exchangers in a biomass heating plant. Heat exchanger specification, nanofluid properties and mathematical formulations were taken from the literature to analyze thermal and energy performance of the heat recovery system. It was observed that the convective and overall heat transfer coefficient increased with the application of nanofluids compared to ethylene glycol or water based fluids. It addition, 7.6% of the heat transfer enhancement could be achieved with the addition of 1% copper nanoparticles in ethylene glycol based fluid at a mass flow rate of 26.3 and 116.0 kg/s for flue gas and coolant, respectively. © 2011 Elsevier Ltd. All rights reserved.

Author keywords

Energy; Flue gas; Heat recovery; Nanofluids

Indexed Keywords

Copper nanoparticles; Energy; Energy performance; Fuel prices; Fuel security; Heat recovery systems; Heat Transfer enhancement; Heating plants; In-shell; Industrial energy; Mass flow rate; Mathematical formulation; Nano-fluid; Nanofluids; Overall heat transfer coefficient; Shell-and-tube; Water-based fluids; Working fluid

Engineering controlled terms: Climate change; Coolants; Ethylene, Ethylene glycol; Flue gases; Fluids; Gas plants; Heat exchangers; Heat transfer coefficients; Recovery; Space heating; Waste heat; Waste heat utilization

Engineering main heading: Nanofluids

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