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**Factorial experimental design for the thermal performance of a double pipe heat exchanger using Al2O3-TiO2 hybrid nanofluid**
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**Abstract**
Applying nanofluids with modification in the structure have engrossed in fluid mechanics. This utilization has demonstrated significant enhancement in heat exchangers performance. In this work, a double pipe heat exchanger with loaded Al2O3-TiO2 hybrid nanofluid in turbulent flow regimes is studied and evaluated through exergy analysis. Praised equations are employed to verify the resulted information. In order to obtain the exergy efficiency of the nanofluid-loaded double pipe heat exchanger a complete factorial experimental design approach was employed. Nanofluid concentration in the range of 0.2 to 1.5, Reynolds number from 3000 to 12000, and twist ratio between 2 to 8 are considered as the test's variables. Statistical analysis including the Student's t-test, variance analysis, F-test, and lack of fit is performed to determine the most significant parameters on the exergy efficiency. It is concluded that applying nanocomposites and twisted tapes boost up the exergy efficiency in comparison to utilizing conventional water as a heat transfer fluid. Moreover, raising the nanoparticles volume concentration and the Reynolds number, simultaneous to decreasing the twist ratio can result in higher exergy efficiency. © 2018 Elsevier Ltd

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