Entropy and Exergy Analysis in an Experimental Thermal System Used GO–DW Nanofluid Having Straight Copper Pipes with Different Diameters

N. Ocak[1*] and K. Karabulut[2]**

[1] *Sivas Cumhuriyet University, Institute of Science, Department of Energy Science and Technology Engineering, Sivas, Turkey*

[2] *Sivas Cumhuriyet University, Sivas Technical Sciences Vocational School, Electric and Energy Department, Sivas, Turkey*

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Abstract—Entropy and exergy analysis of a thermal system are the most powerful tools that can be employed to specify the optimum operating conditions of that system and utilization rate from the system. In the experimental thermal system in this work, entropy generation and exergy analyzes of GO–DW nanofluids have been carried out in straight copper pipes with constant heat load and 8 mm and 16 mm inner diameters. While the heat loads applied to the pipes are 250 W and 350 W, the range of fluid flow rate values in the pipes is 0.9 l/min–1.8 l/min. GO–DW nanofluids with 0.01% and 0.02% volumetric concentrations and DW have been used as working fluids in the pipes. The outcomes acquired from this work have been matched with the studies using different nanofluids in the literature and it has been noticed that the outcomes are reasonable and consistent. The results of the study have been presented at different GO–DW nanofluid concentrations in pipes with 8 mm and 16 mm inner diameters as thermal, friction and total entropy production, output exergy ratio and 2nd law efficiency. The obtained outcomes have exhibited that the lowest total entropy generation has been obtained for the 8 mm diameter pipe and the nanofluid with 0.02% GO–DW concentration. Besides, 2nd law efficiency is 12% higher for the 8 mm diameter pipe than 16 mm at flow rate of 1.2 l/min and 0.02% GO–DW nanofluid, and 350 W heat load.

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