



# Improve thermal performance of Simulated-Body-Fluid as a solution with an ion concentration close to human blood plasma, by additive Zinc Oxide and its composites: ZnO/Carbon Nanotube and ZnO/Hydroxyapatite

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## Abstract

Nanofluid is a suspension of Nanoparticles in a basefluid. Typical fluids carry less heat transfer than nanofluids. However, the perception of heat transfer for bio-nanomaterials can help scientists in fields as implant coatings, nano-robotics, etc. In this research, heat transfer of Zinc Oxide (ZnO) in Simulated-Body-Fluid (SBF) was studied. Then, heat transfer of ZnO/Carbon Nanotube and ZnO/Hydroxyapatite in SBF was studied. After that, the results were compared experimentally and numerically. The numerical optimization was done by Artificial Neural Network and Fuzzy system. To make the ZnO/SBF mono nanofluid, first, five volume fractions of 0.2–1.0% were made. Also, ZnO-HA/SBF and ZnO-CNT/SBF hybrid nanofluid samples were made in the same volume fractions, individually. After that, heat transfer was measured at temperatures of 20–50 °C. Also, Artificial Neural Networks with Levenberg-Marquardt and Orthogonal-Distance-Regression algorithms were modeled. Then, Fuzzy system was employed to train the data with the least uncertainty. Results showed that in comparison with ZnO-SBF nanofluid, the effects of adding Hydroxyapatite and Carbon Nanotube are heat transfer enhancement of –16.73% and +17.49% at 1.0vol% and 50 (°C), individually. Also, computational process can be employed to optimize the “nanofluid's heat transfer measurement” for cost-reduction in experiments.