New Correlations for the Thermal Conductivity and the Dynamic Viscosity of Nanofluids Based on Water and Metal Oxide Nanoparticles

Giovanni Di Nicola [S], Gianluca Coccia, Mariano Pierantozzi and Sebastiano Tomassetti [C]
Dipartimento di Ingegneria Industriale e Scienze Matematiche, Università Politecnica delle Marche, Ancona, Italy
s.tomassetti@pm.univpm.it

Giulio Santori
School of Engineering, Institute for Materials and Processes, The University of Edinburgh, Edinburgh, Scotland, United Kingdom

Nanofluids are a new class of heat transfer fluids obtained through different processes, consisting of a dispersion of solid particles with nanometric dimension in a base fluid. In the last years, nanofluids drew the attention of the research community thanks to their potential to improve the convective heat transfer coefficient in several energy systems, solar collectors, in particular. A direct and relevant consequence of this improvement is a better thermal efficiency of the overall system. However, a precise and reliable estimation of the convective heat transfer coefficient requires an accurate determination of the two most important thermophysical properties of a nanofluid, i.e. thermal conductivity and dynamic viscosity. Thus, in this work a large experimental dataset of these two properties was built for water-based nanofluids having metal oxides as nanoparticles. The experimental data were gathered from selected published papers. The dataset was analyzed with a factor analysis approach, in order to identify the most important parameters that influence the thermal conductivity and the dynamic viscosity. Then, two simple and accurate semi-empirical correlations were built for the two thermophysical properties. Results show that the proposed correlations estimate well the thermal conductivity and the dynamic viscosity, providing low deviations respect to experimental measurements and other correlations available in literature.