Thermal Conductivity of IoNanoFluids

Ana Paula Ribeiro [S], Maria Lourenço and Carlos Nieto de Castro [C]
Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal

Complex systems based on nanomaterials and common solvents have been demonstrated to have thermophysical properties that can revolutionize the actual utilization of heat transfer fluids and heat storage cycles. This is mainly caused by the existence of thermal conductivity enhancements derived from the presence of additional mechanisms of heat transfer, in comparison with the base solvent. It is today a “hot topic” if this thermal conductivity enhancement is significant to modify the actual use of heat transfer fluids, and, if we can understand what are the additional mechanisms of heat transfer (suggested to be Brownian motion, aggregation privileged heat paths or other)[1]. Ionic liquids have been shown to have thermophysical properties that justify the replacement of several of the chemical processes now under exploitation, and some of the solvents used, because they can, in certain conditions, be considered as green solvents. However the optimal technological design of green processes requires the characterization of the ionic liquids used, namely their thermodynamic, transport and dielectric properties. Dissolving (or mixing as a thermally stable suspension) nanoparticles (spheres, tubes, etc.) in ionic liquids, forms “bucky gels”[2] (we prefer to call them IoNanoFluids), which we have shown recently to have thermal conductivity enhancements, ranging from 5 to 35 %[3]. Their possible use as heat transfer fluids, non-volatile and having a high heat capacity density, is currently under discussion. Here we report additional data of IoNanoFluids, nanofluids constituted by particles or tubes of nanomaterials (MWCNT’s, TiO_2) in n-alkylmethylimidazolium salts, discussing the mechanisms of heat transfer at the molecular level.

[1] P. Keblinski, R. Prasher and J. Eapen, J. Nanopart. Res. 10, 1089 (2008)
[2] T. Fukushima, A. Kosaka, Y. Ishimura, T. Yamamoto, T. Takigawa, N. Ishii, and T. Aida, Science, 300, 2072 (2003); T. Fukushima, T. Aida, Chem. Eur. J., 13, 5048 (2007)
[3] A. P. Ribeiro, M. J. Lourenço, C. A. Nieto de Castro, C. Hardacre, Poster presented at the EUCHEM 2008 Conference on Molten Salts and Ionic Liquids, August 24-29, 2008, Copenhagen, Denmark