Linking the macroscopic properties of nanofluids with the interfaces configuration

Javier Navas,[1] Ivan Carrillo-Berdugo,[1] Ricardo Grau-Crespo[2]

University of Cádiz, Campus Universitario de Puerto Real, Facultad de Ciencias, Departamento de Química Física, Puerto Real (Cádiz), Spain
University of Reading, Department of Chemistry, School of Chemistry, Food and Pharmacy, Reading RG6 6AD, United Kingdom
javier.navas@uca.es

Interfaces have a huge influence on the properties of nanostructured materials, and controlling the configuration of the interfaces opens the way for the development of highly functional materials with optimized properties that cannot be achieved at the bulk scale. Nanofluids, colloidal suspensions of nanomaterials in a base fluid, are a good example of this observation. It has recently been proven, through DFT/MD simulations and experimental data, that the chemical interactions between the species of the base fluid and the dispersed nanomaterial affects the thermal conductivity and the specific heat of these nanofluids [1-3], which is of interest for advanced applications of heat transfer and storage. However, choosing the right nanofluid for a particular application is a complex process that requires rationalization.
Thus, in this work, we present the rationalization of the thermal properties, specific heat and thermal conductivity, of the metal-containing nanofluids through both experimental and theoretical perspectives. Pd and Au nanoplates were synthesized (see Figure 1) and nanofluids were prepared using a synthetic oil (the eutectic mixture of biphenyl and diphenyl oxide as the base fluid. These nanolufids were characterized in their properties of interest, colloidal stability, thermal and rheological properties. The chemical configuration of the interfaces was studied through DFT/MD simulations. Thanks to the dual perspective, a correlation between the interactions on the interface and the properties measured was performed. This correlation can allow to predict the nature of the components of the nanofluids for a specific application.

References

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Figures

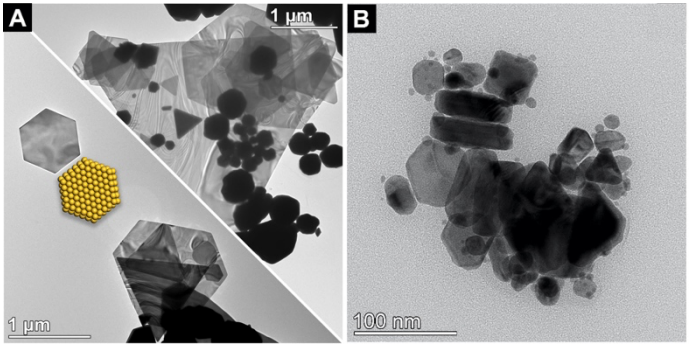

Figure 1: TEM images of gold (A) and Pd (B) nanoplates.