Graphene as lubricant additive of ionic liquids

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The rheological characterization of ionic liquids has awaken a strong interest in the scientific community since this is one of the principal features to be taken into account for tribological applications [1]. In a Newtonian flow, shear stress is proportional to shear rate and the viscous behavior is not affected by shear rate. In the case of fluids with certain degree of phase ordering, the non-Newtonian phenomenon is typically prevalent. Shear thinning of ILs has been reported previously in the literature because of the existence of liquid phase aggregates or networks [1,2]. The usage of carbon nanosystems as modifiers of the behavior of ionic liquids has increased these last years, leading to a number of relevant studies. The development of large numbers of new ILs with many different technological applications and their ability to disperse the different carbon structures are among their main advantages [3]. In this work, we present the rheological characterization of dispersions of carbon nanotubes in 1-ethyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide. We have evaluated the effect of addition of graphene and temperature on the viscosity under shear rate. The dispersion has an anomalous increasing of the viscosity when the temperature is raised at high graphene concentrations (Figure 1). Furthermore, these nanofluids have been tested as lubricants with and outstanding tribological behavior (Figure 2).

References

[1] [1] G.L. Burrell, N.F. Dunlop, F. Separovic. Soft Matter, 6 (2010) 2080-2086

[2] T. Amann, C. Dold, A. Kailer. Soft Matter, 8 (2012) 9840-9846

[3] C. Espejo, F.J. Carrión, D. Martínez, M.D. Bermúdez. Tribology Letters, 50 (2013) 127-136

Figures

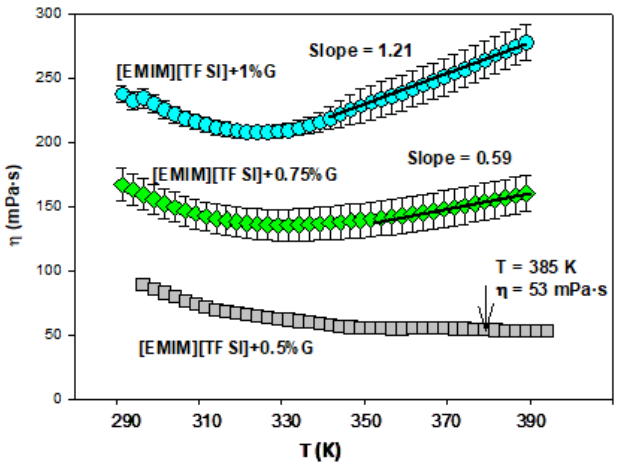

Figure 1: Temperature dependence of viscosity with the addition of graphene.

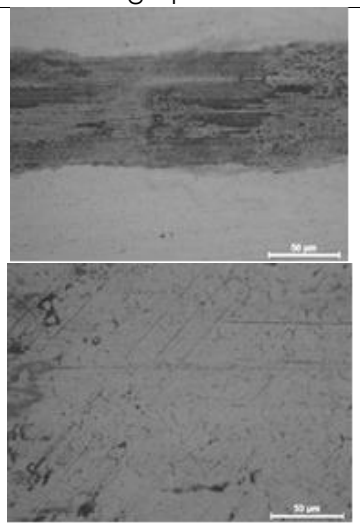

Figure 2: Wear track of the ionic liquid and the 1 wt.% graphene dispersion on ceramic-steel contacts.