11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Preparation of stable dispersions of Co and Pd nanoparticles using an imidazolium ionic liquid

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Abstract – Cobalt and palladium nanoparticles were prepared in imidazolium ionic liquid by thermal decomposition and reduction of metal precursors. The stability of metal nanoparticles dispersion in ionic liquid was evaluated using multiple light scattering (Turbiscan®). The most stable dispersion was the Co nanoparticles in BMI.N(Tf)$_2$.

Metallic nanoparticles have been studied because nanostructures of metals significantly differ from those of the bulk phases. The magnetic, optical and catalytic properties of soluble metal nanoparticles (MNPs) depend primary on the type and nature of stabilizer.[1, 2] MNPs can be produced in organic solvents (alcohols or tetrahydrofuran); however, the properties of those nanoparticles cannot be investigated in solution due to the low stabilization properties of the solvents. Recently, our research group has synthesized metal nanoparticles (Co, Pd, Pt, Rh) in imidazolium ionic liquid to catalytic applications.[3-5]
The objective of this work was to investigate the stability of Co and Pd nanoparticle dispersions in imidazolium ionic liquid. Using multiple light scattering (Turbiscan® Lab, Formulaction, France), transmission profiles were obtained at 25, 40 and 50 °C. The initial mean sizes of both dispersions was 7.4 nm. The relative transmission profiles (T) showed sedimentation besides agglomeration of the nanoparticles (NP). The increase in the particle size increased the transmission (Fig. 1). The ΔT profiles as a function of time, obtained at 20 mm from the bottom, showed that different behaviors are observed for Pd NP and for Co NP. For Pd NP, the shape of ΔT profiles are different, suggesting that the supramolecular structure in the ionic liquid changed after varying the temperature (Fig.1a). On the other hand, for Co NP the ΔT profile at 25 °C showed no variation in size, whereas at 40 °C and 50 °C a slight variation was observed (Fig.1b). This stability can be caused by face of crystals or the electronic metal characteristics. In conclusion, the of Co NP dispersed in BMI.N(Tf)$_2$ was more stable than Pd NP.

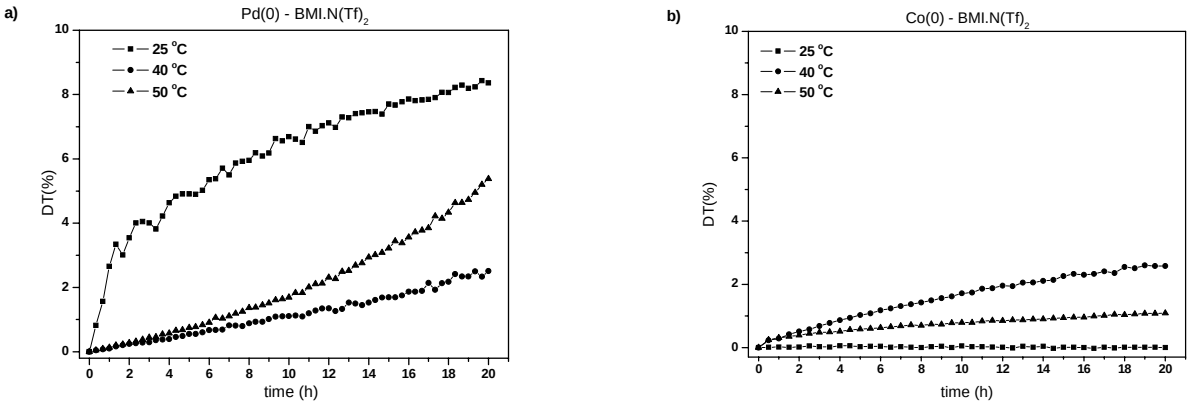

Figure 1: a) ΔT of Pd NP in BMI.N(Tf)$_2$; b) ΔT of Co NP in BMI.N(Tf)$_2$.

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