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IONIC LIQUIDS AS ADDITIVES FOR POLYMER NANOCOMPOSITES

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The formation of inorganic/organic nanocomposites has shown ability of providing a feasible approach of simultaneously improving the thermal, mechanical and flame retardant properties as well as dimensional stability of polymeric materials. Different additives are used to modify the nanocomposites and improve their properties. Ionic liquids (ILs) are such prospective additives.
ILs are organic salts with melting points below 100 ^{o}C. Most of those ILs present insignificant vapor pressure, good solvent characteristics, thermal and chemical stability, low flammability, high ionic conductivity and self-organization in the liquid state. Due to these characteristics, ILs have attracted considerable interest for both basic research and industrial applications. Recently, imidazolium derived ILs showed to be capable of exerting influence on the silica structure/properties when applied in the sol-gel system. Epoxy networks have important industrial applications and the production of an *in situ* silica/epoxy nanocomposite that can "inherit" these advanced IL characteristics appears very promising for obtaining polymer nanocomposites with improved properties.
This work addresses for the first time the use of ILs as additives for the *in situ* formation of epoxy-silica rubbery nanocomposites, via the sol-gel process. The silica/epoxy nanocomposite system produced in this research was obtained by the simultaneous formation of nanosilica filler and the organic polymer matrix. The first synthetic step consisted in the tetraethoxysilane (TEOS) based sol-gel reaction realized in the presence of a series of ILs. In the second step, the hydrolyzed sol was introduced in the reacting epoxy system; diglycidyl ether of Bisphenol A – diamine. The diamines acted simultaneously as curing agent of the epoxy monomer and basic catalyst for the condensation of the sol-gel silica. The structural and morphology properties of the formed materials were characterized by small-angle X-ray scattering (SAXS) and transmission electron microscopy (TEM) analysis. The influence of IL on the mechanical properties of the silica/epoxy nanocomposites was studied by dynamic-mechanical analysis (DMA). The results proved the effect of IL on properties of nanocomposites. ILs (in catalytic amount) promoted improved dispersion of the silica filler and consequent increased dynamic-mechanical properties by controlling the silica structure and/or increasing the nanofiller-matrix interaction.