Abstract of PhD dissertation entitled

"EPOXY COMPOSITIONS AND COMPOSITES WITH LATENT CURING AGENTS"

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The aim of this work was testing of ionic liquids, i.e. molecular ionic liquids and deep eutectic liquids, as crosslinking agents for epoxy resins and characteristics of cured epoxy materials.

Molecular ionic liquids of different cation (imidazolium and phosphonium) type and anion structure were examined in the context of their effect on curing process characteristics and properties of epoxy cured materials. Moreover, deep eutectic liquids based on choline chloride and various hydrogen donor compounds (or metals halides) were prepared and tested as epoxy resin curing agents for the first time.

The influence of type and content of ionic liquids on viscosity, curing process of epoxy compositions, and properties of cured materials was evaluated.

The thesis describes how the content and type of ionic liquids affect a pot life time of the resin composition (on a basis of viscosity measurements of epoxy compositions during storage at room temperature) in order to assess possible features of latency. Curing process of epoxy compositions was investigated using stress rheometry, DSC (differential scanning calorimetry) and FTIR techniques. The evaluated characteristic parameters of curing process were the following: onset and maximum temperatures, enthalpy of curing (based on DSC), viscosity change during heating (from rheometry), as well as change in intensity of bands corresponding to epoxy groups (FTIR).

On the other hand, cured epoxy materials was subjected to tests of thermal (thermogravimetric) and, thermomechanical (dynamic mechanical thermal analysis, DMTA) properties, flammability and electrical conductivity. Mechanical properties (tensile and flexural strengths) were evaluated using Instron testing machine.

Moreover, epoxy compositions and composites with carbon nanofillers were manufactured. An evaluation of content and kind of carbon nanofillers, effect of ionic liquid and filler on epoxy compositions viscosities, characteristics of crosslinking reaction, thermal, thermomechanical, flammability properties, and electrical conductivity of epoxy nanocomposites were performed. Introduction of carbon nanofillers into epoxy resin caused substantial improvement of epoxy composites properties such as mechanical, electrical and thermal conductivities and thermal or flame resiststance. It also was found that ionic liquids were effective media for dispersion of carbon nanofillers in liquid epoxy resin compositions.

Key words: epoxy resin, ionic liquids, deep eutectic liquids, curing process, carbon nanofillers, nanocomposites, electrical properties