

# Nanocomposites and nanomaterials

## Thermal properties of hybrid polyamidoimide-polyurethane-epoxycyclohexyl POSS nanocomposites

O.M. Starostenko<sup>1</sup>, O.P. Grigoryeva<sup>1</sup>, A.M. Fainleib<sup>1</sup>, B. Youssef<sup>2,3</sup>,  
J.-M. Saiter<sup>2</sup>

<sup>1</sup> Department of Heterochain Polymers and Interpenetrating Polymer Networks, Institute of Macromolecular Chemistry, Natl. Acad. of Sci. of Ukraine. Kharkivs'ke shose, 48, Kiev-02160, Ukraine.

E-mail: [o\\_starostenko@ukr.net](mailto:o_starostenko@ukr.net)

<sup>2</sup> AMME-LECAP, EA 4528, International Laboratory, Institute of Material Research FED4114, Université de Rouen, 76801 Saint Etienne du Rouvray, France

<sup>3</sup> INSA de Rouen, BP 08 Av. de l'Université, 76801, St. Etienne du Rouvray, France

Thermal properties and chemical structure of new film materials based on organic-inorganic nanocomposites obtained *in situ* from a linear polyamidoimide (PAI, 90 wt.%) containing ~ 50% of acid-amide fragments, linear segmented polyurethane (PU, 10 wt.%) and epoxycyclohexyl polyhedral oligomeric silsesquioxane (ECH-POSS) were studied. The ECH-POSS content was varied from 1 to 4.8 wt.%. It is established that during the synthesis of PAI/PU/ECH-POSS nanocomposites, the following basic chemical processes occurred: 1) partial imidization of acid-amide fragments of PAI and 2) chemical interaction between epoxy groups of ECH-POSS and reactive groups of PAI. The chemical interaction of ECH-POSS with PAI and formation of the PAI-graft-POSS are confirmed by FTIR spectroscopy data. Using TGA technique it has been found that thermal stability of the PAI/PU/ECH-POSS nanocomposites is higher than that for the unfilled PAI/PU matrix and the highest thermal stability is fixed for the nanocomposite containing 1.0 wt.% of ECH-POSS. Afterwards, to complete imidization of PAI-component of PAI/PU/ECH-POSS nanocomposites additional thermal treatment of the samples from  $T = 25$  °C to  $T = 280$  °C for 8.5 h was carried out. It has been established that after heating all the nanocomposites studied exhibit improved thermal characteristics.