

STRUCTURE AND PROPERTIES OF CHEMICALLY SYNTHESIZED FERRITES AND MAGNETIC COMPOSITES BASED ON POLYCARBONATE

¹Zalīte Ilmars, ²Merijs Meri Remo, ²Zicans Janis, ²Bitenieks Juris, ¹Heidemane Gundega, ¹Kodols Maris, ³Knite Maris

¹Institute of Inorganic Chemistry of the Riga Technical University

²Institute of Polymer Materials, Riga Technical University

³Institute of Technical Physics, Riga Technical University

Polymer nanocomposites are increasingly used in various areas of national economy. Especially attractive are nanocomposites based on common thermoplastic polymers such as polyolefins, aromatic polyesters, polyamides and others, enabling high manufacturing productivity. Regarding nanofillers carbon nanotubes, organically modified clays, nature born fibres and magnetic particulates are broadly used to improve various properties of the base polymers. The effectiveness of the modification of polymers by nanofillers strongly depends on the interaction between polymer matrix and nanostructured filler. Consequently in this research main attention is devoted to the structure-properties relationships of the ferrite modified polycarbonate (PC) nanocomposites.

Chemically synthesized CoFe_2O_4 and NiFe_2O_4 were used as nanostructured modifiers for commercial grade PC. The ferrites were obtained by means of sol-gel auto-combustion synthesis from the nitrates of the respective metals, glycine and nitric acid. Obtained nanopowders were initially characterized by using X-ray analysis, vibrating sample magnetometry and BET single point method. PC based nanocomposites were obtained by means of conventional melt compounding. The ferrite content in the PC matrix was changed in the interval from 0 to 10 wt. %. PC/ CoFe_2O_4 and PC/ NiFe_2O_4 nanocomposites were characterized by means of rotation viscosimetry, dynamic mechanical thermal analysis, thermogravimetry, dielectric spectroscopy and vibrating sample magnetometry. Especial attention is devoted to the structure-property relationships of the investigated binary systems.

Results of the rheological tests testify that PC/ CoFe_2O_4 and PC/ NiFe_2O_4 nanocomposites, especially the later ones, possess low viscosities allowing shaping them in various complex forms. It is also demonstrated that the nanocomposites exhibit decreased thermal resistance and elasticity along with increasing ferrite amounts in the polymer matrix. It is also demonstrated that the addition of minor amounts of the ferrite nanofiller allows increasing stiffness of the PC matrix based nanocomposites, which is most probably attributed to the specific interaction between the filler and the matrix, confirmed also by corresponding relaxational investigations. Equally it is shown that the addition of the ferrite nanofiller assigns certain magnetic properties to the investigated composites as well as improves its conductivity, especially at high frequency region.

It is believed that nanocomposites, investigated in this research, could find some application as electrostatic discharge materials or even materials for electromagnetic radiation absorption.

The research is carried out in the framework of the ESF project Nr. 2009/0202/1DP/1.1.1.2.0/09/APIA/VIAA/082 „Development of new manufacturing methods for preparation of refractory metal powders and nanostructured composite materials”