Contribution ID: **104** Contribution code: **S06-CMPSP-222** Type: **Poster presentation**

Polymer nanocomposites filled with core-shell nanoparticles for nanodielectric application

Tuesday 30 August 2022 18:00 (1h 30m)

Polymer nanocomposites are prepared by a simple and environmentally friendly technique. First, sheets of isotactic polypropylene (iPP) and atactic polystyrene (aPS) were prepared by compression molding with Servitec Polystat Press 200 T at 473.15 K and 3.0 MPa pressure followed by quenching in water at room temperature. The polymer sheets thus prepared were then immersed separately in three saturated salt water solutions (MnCl2, FeCl2, and NiCl2), at two temperatures (23°C and 90°C), and under influence of two DC electrical potentials (+4 kV, and ground potential). Count profiles and generated images of TOF –SIMS records have shown that higher temperature treatment (90°C) and positive potential (+4kV) have given the highest count of iron ions and better distribution and dispersion of nanoparticles in polymer matrices. Also, the measured concentration of transition metals by ICP-OES confirmed higher concentrations of metals in nanocomposites obtained by these treatment conditions. It was stated that iron(II)-chloride had the highest concentration in iPP and aPS matrices in comparison to the other two transition salts. TEM micrographs showed spherically-shaped cores in the core-shell system and agglomerated particles of irregular shape. Encapsulation of iron cores prevented nanoparticles from agglomeration. The cores of the investigated particles were probably iron oxides and/or hydroxides that occurred during the hydrolysis of iron salts in deionized water solution. Dielectric properties of obtained nanodielectrics were investigated. Relative dielectric constant and loss tangent has been studied in the frequency range from 20 Hz to 9 MHz. It was shown that adding the small amount of core-shell nanoparticles (from 15 nm to 150 nm in diameter) in a very small amount (1.72E-8 mol/cm3 to 1.17E-5 mol/cm3) are resulted in significant improvement and stabilization of relative dielectric constant value and also lowering loss tangent in compare to starting polymer matrices.These dielectric properties were marked as suitable for nanodielectric application for high speed and high dencity microelectronic packaging.

Primary author: PETRONIJEVIĆ, Ivan (Faculty of Physics, University of Belgrade, Studentski trg 12, 11000, Belgrade, Serbia)

Co-authors: Dr DUDIĆ, Duško (Vinča Institute of Nuclear Sciences –National Institute of the Republic of Serbia, University of Belgrade, Mihajla Petrovića Alasa 12–14, Belgrade, Serbia); Dr CEROVIĆ, Dragana (Academy of Technical and Art Applied Studies Belgrade, Department Textile School of Applied Studies for Design, Technology, and Management, Starine Novaka 24, 11000 Belgrade, Serbia); Prof. MALETIĆ, Slavica (Faculty of Physics, University of Belgrade, Studentski trg 12, 11000, Belgrade, Serbia); Mr MARINKOVIĆ, Filip (Faculty of Physics, University of Belgrade, Studentski trg 12, 11000, Belgrade, Serbia); Dr PERGAL, Marija (Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Njegoseva 12, 11000 Belgrade, Serbia); Dr ANĐELKOVIĆ, Ljubica (Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Njegoseva 12, 11000 Belgrade, Serbia)

Presenter: PETRONIJEVIĆ, Ivan (Faculty of Physics, University of Belgrade, Studentski trg 12, 11000, Belgrade, Serbia)

Session Classification: Poster session

Track Classification: Scientific Sections: S06 Condensed Matter Physics and Statistical Physics