Nanocomposites and nanomaterials

Nanocomposites based on interpolyelectrolyte complex poly(4-vinylpyridine-pectin and Ag^0 nanoparticles formed under the effect of magnetic or electric field: Structure and thermomechanical properties

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For many decades, silver nanoparticles have been recognized as an antimicrobial agent and used in many fields including biomedical, food packaging, waste water treatment, etc. This explains the interest to the development of metal-polymer nanocomposites with controlled structure and properties.

WAXS investigations show that transfer from pectin-P4VP IPEC (interpolyelectrolyte complexes) to pectin-Ag^+-P4VP IPMC (interpolyelectrolyte-metallic complexes) is displayed on the diffractogram as a diffusion-type maximum at $2\theta_m \approx 11{,}0^o$ inherent to interpolyelectrolyte-metallic complexes. It is revealed that as the result of Ag^+ cations reduction in IPMC bulk (with support from sodium boron-hydrate) "IPEC-Ag^0 nanoparticles" nanocomposite is formed. It is shown that Ag^+ reduction in IPMC under the effect of magnetic or electric field takes place with formation of nanocomposite with higher metal content.

By means of SAXS it is shown that relative level of structure heterogeneity grows up considerably in the following sequence: IPEC pectin-P4VP → IPMC pectin-Ag^+-P4VP → nanocomposite IPEC-Ag^0 (without field effect) → nanocomposite IPEC-Ag^0 (effected with electric field) → nanocomposite IPEC-Ag^0 (effected with magnetic field).

Thermomechanical analysis methods show that nanocomposite IPEC-Ag^0 formed under electric or constant magnetic field effect has higher glass-transition temperature T_g and relative deformation ε comparing with material received without field effect.