

Environmentally-safe polymer-metal nanocomposites

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The environmental safety of nanocomposite materials (which consist of or contain nanosize components) is one of the hottest topics of the modern Nanotechnology within the last few years. The main concerns dealing with the rapid development and commercialization of various nanomaterials (NM) are associated with 1) the approved higher toxicity of many nanomaterials (NM) in comparison with their larger counterparts, 2) the absence of the adequate analytical techniques for detection of NM in the environment, and 3) the absence of the legislation normative for permitted levels of various NM in water and air. In this regard the increase of the safety of NM is of particular importance.

In our presentation we report the results obtained by the development of the environmentally-safe polymer-metal nanocomposite materials, which can be applied in various fields, such as catalysis, water treatment and others. The material represents a functional polymer with immobilized metal nanoparticles (MNPs) distributed mainly by the surface of polymer that makes them maximally accessible for the substrate to be catalyzed or eliminated. MNPs have a core-shell structure and consist of a superparamagnetic core coated with the functional metal shell of the minimal thickness, which provides the desired activity of nanocomposite material. The MNPs are strongly captured inside polymer matrix that prevents their escape into the medium under treatment. The superparamagnetic nature of MNPs provides an additional level of the material safety as MNPs leached from the polymer matrix can be easily captured by the magnetic traps that permits either to completely prevent any post-contamination of the treated medium or recycle MNPs what is particularly important when they contain precious metals. The presence of MNPs does not block the functional groups of the polymer so that the polymer-metal nanocomposite can also function as the dual function material.