Polymer/Nanodiamond Composite Materials. Perspectives, Opportunities, Results

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The structure, properties and practical applications of polymer nanocomposites are the subject of intensive worldwide studies. In this respect, the most advantageous are the systems in which one component is highly dispersed in a polymer matrix and shows a high aspect ratio. For such a system one can expect marked changes in the mechanical characteristics of the related nanocomposites, especially in the case of strong interaction between nanoparticles and polymer matrix. The modification of the polymer matrix seems to be effective under some additional requirements imposed [1-3]: (1) the nanoparticles should have a narrow size distribution; (2) the typical (linear) dimensions of the nanoparticles and mean distances between the nanoparticles dispersed in a polymer matrix should not differ remarkably with a radius of gyration of macromolecules; (3) the nanoparticle-polymer matrix interaction should be "optimal" to ensure the possibility of their dispersion as well as their subsequent immobilization in a polymer matrix in order to prevent particles aggregation upon treatment or storing of the material.

The promising component for the polymer nanocomposites is nanodiamond prepared by the detonation synthesis (NDDS) [4, 5]. NDDSs are able to form anisodiametric nanosized “unbreakable aggregates” that can be used as effective modifying agents providing improved mechanical characteristics of the filled polymer systems. In this work we examine the structure and mechanical properties of the new thermoplastic elastomer/NDDS composites as well as poly(vinyl alcohol)/NDDS composites (films and fibres).

The perspectives and opportunities in the design of new types of polymer/NDDS nanocomposites are reviewed and discussed.

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