Comparison of Nanodiamonds and Fumed Silica as Modifiers of EOC Properties

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The work proceeds with the study of nanomodificators effect on structure and physical-mechanical properties of low density ethylene-octen copolymer (EOC) [1].

The main aim of our study was the analysis of the dependence of nanocomposites properties on nanomodifier chemical nature and elastic matrix properties. As the main object of investigation EOC-0.885 was chosen. Nanodiamonds (ND) and fumed silica (FS) with S=300 and 450 m^2/g were used as nanomodifiers. It has been found that FS are considerably less effective for mechanical properties improvement of EOC than ND, especially at low contents of modifiers. More strongly efficiency ND as nuclei of crystallization in comparison with FS is very likely, connected with fractal structure of their small clusters. This assumption agrees with the notion about initial clusters in homogeneous crystallization as small fractals with some excess of surface energy [2]. It has been stated that introduction of ND particles into EOC-0.885 (more crystalline matrix than EOC-0.86, which has been investigated early [1]) also leads to the formation of the more perfect crystalline phases, increases the rate of crystallization and degree of crystallinity, resulting in increase in strength and Young modulus, especially at low content (0.05 mass.%) of the modifier. The analyses of entropy and energy contributions in deformation thermodynamics was carried out using deformation calorimetry. It was stated that thermomechanical behavior of the copolymers under investigation is similar to the behavior of typical thermoelastoplastics. It was shown that the effect of ND on EOC depends on the modifier content and crystallinity of the matrix. The inter- and intramolecular energy contributions were estimated using statistic theory of elasticity.

The work was supported by Russian Foundation for Basic Research (grant 06-03-37790).

[1] A.P. Korobko et al. *Diamond & Related Materials* **16**, 2141 (2007).
[2] B.M. Smirnov, *Physical Reports* **188**(1), 1 (1990).