Self-organization processes in polymeric nanocomposites with C_{60} fullerenes

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As shown previously [1], use of C_{60} fullerenes enables synthesis of polymeric materials with noticeably improved physicochemical properties. The present study is concerned with such composite materials as polyblock polysiloxane copolymers modified with C60 fullerenes. The chosen polymer is convenient for modeling the structure--property relationship as regards the influence of highly dispersed substances on the supramolecular organization of polymeric nanocomposites. A number of physical techniques were used: method of neutron scattering (NS) and electron microscopy (TEM). Materials containing 0.5, 2, and 4 wt.% C_{60} were examined. According to the results of an NS study, introduction of C_{60} fullerenes into the polymer gives rise to additional (compared with the starting polymer) scattering centers (Figure). TEM data (Fig. 1, inset) demonstrated the absence of separate C_{60} clusters. Thus, the appearance of new scattering centers can be attributed to self-organization processes occurring under the action of coordinating fields of fullerenes, and specifically to formation of rigid-block clusters containing C_{60} molecules. The suggested model is well correlated with the complex of chemical properties (diffuse permeability) and with the complex of elastic-strength parameters of the composite.

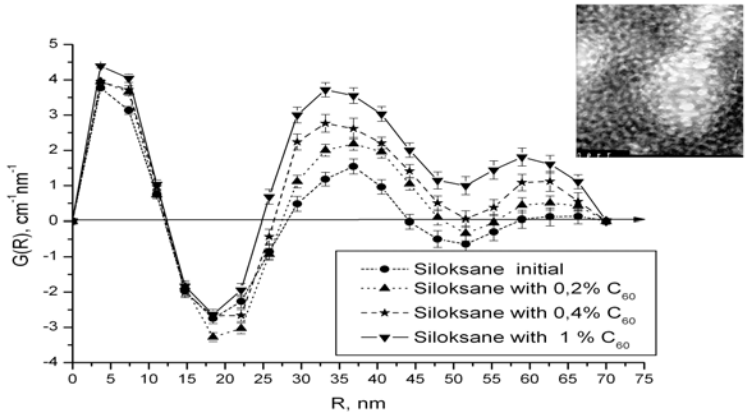

Figure. Correlation functions G(R) of scattering structures in nanocomposite siloxane films. Inset. TEM micrograph of a nanocomposite with 0.5 wt.% C_{60}.

[1] A.P. Voznyakovsky, M.F. Kudoyarov, M.Ya. Patrova. *Let. JTPh* **33**(16), 86 (2007).