Nanocomposites and nanomaterials

The processes of structural relaxation in the nanocomposite material made of polyethylene-carbon nanotubes

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One of the effective methods for studying the processes responsible for the formation of physical, chemical, mechanical and operational characteristics of solid states is a method of mechanical spectroscopy or method of internal friction. It is known that polyethylene (PE) behaves nonlinear and inelastic even at smallest deformation amplitudes. This behavior persists in compositions based on it.

The structure of PE is amorphous-crystalline and nature of relaxation processes in the measurement of amplitude-dependent internal friction (ADIF) will depend on the volume content of the crystalline and amorphous phases in it. The paper examined samples of nanocomposite material (NCM) made of low pressure polyethylene containing multi-walled carbon nanotubes (MWCNT) with different concentration.

Established that ADIF for all investigated NCM in the field of relative deformations = (0,5...2) 10^{-4} have the minimum. The presence of these minimum indicates that for these deformations there are certain interactions between the structural elements that differ from those that took place for the deformations where = 10^{-5} and greater deformations where = (3…20) 10^{-4}. In addition, while MWCNT concentration in the NCM raises the minimum width increases.

The paper also presents the results of research of micro hardness, elasticity module and ultimate tensile strength. It was shown that their characteristics were determined by the degree of NCM matrix structuring by its modification by nanotubes.

Therefore, when creating a nanocomposite material based on a polyethylene matrix with carbon filler in the form of multiwalled carbon nanotubes a matrix structuring take place that make possible stabilization of some of its characteristics.