MICROSTRUCTURAL, RHEOLOGICAL, AND CONDUCTOMETRIC STUDIES OF MULTIWALLED CARBON NANOTUBE SUSPENSIONS IN GLYCEROL

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S u m m a r y

Optical microscopy studies of electrical conductivity and rheological properties (in the cone-plate geometry) of glycerol suspensions filled with multiwalled carbon nanotubes (MWCNTs) have been fulfilled. The researches were carried out in the intervals of temperature $T = 283 \div 333$ K and MWCNT concentration $C = 0 \div 1$ wt%. MWCNTs in glycerol are demonstrated to have a strong tendency toward the aggregation, so that "primary" MWCNT aggregates persist even after the intensive ultrasound homogenization. Typical percolation phenomena accompanied by an enhancement of the electrical conductivity and the viscosity are observed at an increase of the MWCNT concentration. The concentration percolation threshold is identified at $C = C_p \approx 0.1$ wt%, and the scaling behavior in a vicinity of the percolation threshold is found to be characterized by the conductivity exponent $t = 2.7 \pm 0.3$, which is somewhat higher than a value typical of the random percolation problem. The introduction of MWCNTs in glycerol resulted in the appearance of thixotropic behavior related to the fracture of MWCNT aggregates under shear. An anomalous rheological behavior is observed at a high MWCNT concentration, $C = 1$ wt%, which testifies to the destruction of the H-bond network in glycerol induced by MWCNTs. The dependences of the activation energies of the ionic electric conductivity and a viscous flow on the MWCNT concentration are estimated.