FORMATION FEATURES OF POLYMER HYBRID NANOCOMPOSITES BASED ON POLYDIPHENYLAMINE-2-CARBOXYLIC ACID

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Polymer-carbon hybrid nanocomposites based on thermostable electroactive polydiphenylamine-2-carboxylic acid (PDPhAC) [1, 2] and single-walled carbon nanotubes (SWCNT) were prepared for the first time. The content of carbon nanotubes [SWCNT] = 1–10 wt% relative to the monomer weight (SWCNT from Carbon Chg, Ltd., d = 1.4–1.6 nm, l = 0.5–1.5 μm). Hybrid SWCNT/PDPhAC nanomaterials were synthesized via in situ oxidative polymerization of diphenylamine-2-carboxylic acid in the presence of SWCNT in the homogeneous acidic medium and in the heterophase system, when the monomer and the SWCNT are in the organic phase (chloroform) and the oxidant (ammonium persulfate) is in an aqueous solution of ammonium hydroxide. The formation of the hybrid SWCNT/PDPhAC nanocomposites includes the monomer immobilization on the SWCNT, with subsequent polymerization *in situ* in an alkaline or acidic medium. The developed SWCNT/PDPhAC nanocomposite materials were characterized by FTIR and electron spectroscopy, solid state HRMAS (high-resolution magic angle spinning) ^{13}C NMR spectroscopy, X-ray diffraction, transmission and field emission scanning electron microscopy, differential scanning calorimetry and thermogravimetric analysis. Chemical structure, as well as electrical and thermal properties of obtained SWCNT/PDPhAC nanocomposites depending on synthesis conditions were investigated. The dependence of the chemical structure and morphology of the polymer matrix on the pH of the reaction medium of nanocomposites synthesis is shown. It was found that during the polymerization in 5 M H_2SO_4 (pH 0.3), the polymer chains grow via the C–C bonding into para position of the phenyl rings in relation to the nitrogen. In a heterophase system in an alkaline medium (pH 11.4), the growth of the polymer chain occurs via the C–C bonding into 2- and 4-positions of the phenyl rings with respect to the nitrogen. The resulting SWCNT/PDPhAC nanocomposites are thermally stable and electrically conductive.

References
1. Ozkan S. Zh., Bondarenko G.N., Karpacheva G.P.Polym. Sci., 2010, 52, 263.
2. Ozkan S.Zh., Eremeev I.S., Karpacheva G.P., Bondarenko G.N. Open J. Polym. Chem., 2013, 3, 63.