

Nanocomposites and nanomaterials

Doping of the composite materials based on methacrylic monomers by inorganic components

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One of the important innovative directions today is the development of fuel cells with proton-conductive polymer membranes (Nafion, MF-4SK) as electrolytes for alternative energy sources. To improve the conductive, mechanical properties, the moisture content, the structure of pores and channels of these materials, the doping with various impurities is used. Copolymers based on methyl methacrylate and methacrylic acid, which are chemically- and thermostable in a wide temperature range and have proton conductivity, as well as inorganic finely dispersed dopants, namely SiO₂, TiO₂ powders, technical soot are of great interest.

Investigation of proton conductivity was carried out on samples of polymer films based on MF-4SK+MMA:MAA with a ratio of 50:50 (MMA:MAA = 60:40) filled with technical carbon K-354 containing carboxyl and hydroxyl groups. To obtain polymer films, 10% solutions of acrylic copolymers in isopropyl alcohol were used.

A linear dependence of the value, which is inverse to the conductivity (resistance of materials) on the change in the frequency of the current for samples with different amounts of technical carbon as a dopant was obtained (Fig. 1).

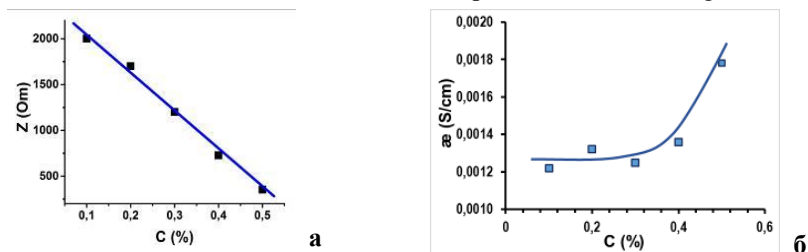


Fig. 1. The dependence of the resistance (a) and conductivity (b) of membranes based on copolymer MF-4SK+MMA:MAA doped technical carbon

As the results showed, even an insignificant amount of inorganic dopant (from 0,1% to 0,5%) leads to an improvement in the mechanical properties and increase in the conductivity of the membrane in four times, which is associated with the introduction of additional carboxyl groups in the composition of the hybrid membrane.