

Nanocomposites and nanomaterials

Insight into action of hybrid nanocomposite membrane for performance of polymer membrane fuel cells

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Nanocomposite perfluorosulfonic membranes containing different types of inorganic species such as various proton conductors shown an increased conductivity with respect to the bare membranes. In the framework of the research on the nature and mechanism of action by XPS, SEM, TPD MS, optical and vibrational spectroscopy investigated the properties of active nanocomposite polymer membranes. Effect of concentration of proton generation additions to the total and specific proton conductivity of composite membranes depending on the concentration of nanoadditives had been estimated. Established, that doped titanium oxide nanospheres due to the nature of their composition and structure have a strong capacity for coordination of water molecules on the surface, formation of hydrated grid structures of labile protons.

It shown, that the conductivity of the Nafion/TiO₂ composite in the studied temperature range confirms the formation of a percolation cluster, in consequence, with mesoscopic ordering and polarization of water molecules on the strong acid groups of doped titanium dioxide species in a frame of Grotgus conductivity mechanism. Above may be a prerequisite for effective behavior nanocomposite polymer membrane in conditions close to the operating conditions of fuel cells.