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Conducting polymer electrolytes for fuel cell applications

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The polymer electrolytes composed of poly(vinylidene fluoride)PVdF and poly(vinyl alcohol)PVA with various ratios of ammonium thiocyanate (NH_4SCN) salt have been prepared by solution casting method. The increase in amorphous nature of polymer electrolytes has been confirmed by XRD analysis. The polymer-salt interactions have been analyzed by FTIR spectroscopy. The Scanning Electron Micrographs affirm the smooth morphology of the polymer electrolytes. A shift in glass transition temperature (T_g) of the electrolytes has been observed from the DSC thermogram which indicates the interaction between polymers and salt. The conductivity and dielectric measurements are carried out on these films as a function of frequency at various temperatures. From the complex impedance spectroscopy, the conductivity is found to be increased in the order of 10^{-9} - 10^{-3} S/cm at room temperature with the increase in salt concentration. The ionic transference number of the mobile ions has been estimated by Wagner's polarization method and the results reveal that the conducting species are predominantly due to ions.

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Modulation of surface hydrophobicity by polymer deposition on micro and nanostructured surfaces and its effect on cells adhesion

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A unique intensive gain of surface hydrophobicity has been observed on the differently polar polymer layers, spin-coated directly on the previously prepared nanostructured nickel surface to form nanohybrids. Nanostructured nickel layer has been prepared by electrochemical deposition to form random polyhedral crystalline nanostructure. Hydrophobicity extension of nanohybrid surfaces increased nearly linearly with decreasing polarity of single polymers applied and maximum increase in hydrophobicity value obtained was 32%. In nanostructured surface declared functionality of surface hydrophobicity extension has not been confirmed on microstructured silver surfaces with dendritic particle geometry where increase in polymer covered surface hydrophobicity was about 6%. Effect on free surface energy, polarizability and hydrophobicity of the surfaces was investigated. The main feature in surface hydrophobicity change was entirely dependent on density of the microparticles. A surface hydrophobicity depended pre-dominantly on the length of dendrite and not on its width geometry. The highest silver surface hydrophobicity has been observed on surface prepared by 30 current pulses with pulse duration of 1 second; the lowest one, when deposition was performed by 10 current pulses with duration of 0.1 second. Partial surface tension coefficients γ_{DS} and polarizability k_{S} of the silver surfaces were calculated. Finally, metallic nanorod surfaces with 50 nm and 500 nm particles high showed superhydrophobic properties. Mentioned effect increased with nanoparticle size. Preparation of random nanostructured surfaces is easy and inexpensive, with many proposed applications where hydrophobic surfaces are required. This also can tend as a model for preparation of the surfaces with cell anti-adhesion and antimicrobial activity. Comparison of particles uniformity could be used to modify surfaces and to modulate human cells and bacteria adhesion on body implants, surgery instruments and clean surfaces.

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