Preparation and Characterization of Nano Titania modified PVA-Pectin polymer electrolyte membranes for DMFC

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***Abstract*——— In this study, poly vinyl alcohol and pectin are *in situ* cross-linked using dual cross-linker comprising a mixture of sulfosuccinic acid and glutaraldehyde followed by solvent casting.Titanium dioxide nanoparticles are incorporated into polymer solutions that controls alignment and disentanglement of polymer chains at molecular level. It is shown that rational design of membrane microstructure with proper arrangement of hydrophobic and hydrophilic domains has been formulated by blending PVA with PC. Water sorption through nanocomposite membrane enhanced when optimum quantity of titanium dioxide particles are present. In addition, titanium dioxide nanoparticles help to provide more inter-connected proton conducting pathways and acts as reinforcing units. Through the hydrogen bonds formed between surface functional groups of titanium oxide nanoparticles and polymer chains, protons are transferred through the membrane both by hopping and vehicular mechanisms. Titanium dioxide nanoparticles also act as fillers and effectively prevent the methanol permeation. Polymer voids are occupied by the presence of Titanium dioxide nanoparticles that selectively allow protons to pass through form anode to cathode side. Both improved proton conductance and lower methanol permeability, electrochemical selectivity of nano Titanium dioxide modified PVA-Pectin polymer electrolyte membrane is enhanced. With further enriched proton conductivity by the presence of titanium dioxide nanoparticles, fabricated pectin polyvinyl alcohol hybrid nanocomposite membrane exhibit higher electrochemical selective factor.**

***Index Terms*—Green electrolytes; Methanol permeability; Nanocomposite; Pectin; Selective transport**