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IONIC CONDUCTIVITY AND RELATED PROPERTIES OF CHITOSAN-GRAPHENE NANO-COMPOSITE MEMBRANES

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Direct alcohol fuel cells (DAFC), which belong to the family of alkaline fuel cells, are electrochemical devices that continuously convert the chemical energy of an alcohol fuel to electricity and show a variety of advantages with respect to hydrogen as a fuel. The heart of a DAFC is an anion exchange membrane (AEM) formed by sandwiching a multi-layered structure (i.e. anode diffusion layer, anode catalyst layer and AEM) between an anode and a cathode. Recently, the sustainable biopolymer chitosan was modified to form derivatives in which the quaternary ammonium groups were anchored to the chitosan matrix to form alkaline AEMs, and then employed in DAFCs. A novel cross-linked quaternized chitosan AEM could exhibit a conductivity up to $7.3 \pm 0.22 \times 10^{-3} \text{ S cm}^{-1}$ with a maximum current density of about 65 mA cm^{-2} (Wan et al., 2008, *J. Power Sources*, 185, 183–187). In this work the chitosan membranes were prepared by a new procedure using Mg(OH)_2 nanoparticles to neutralize the chitosan solution in the presence of graphene oxide and benzyltrimethylammonium chloride. Membranes were characterized in term of morphology by scanning electron and atomic force microscope, the hydrophilicity/hydrophobicity by contact angle measurements, tensile strength at maximum and the tensile strain at break by electromechanical universal testing machine, and ionic conductivity by potentiostat. Results indicated on relative hydrophobic membranes with contact angles of approx. 99° . The addition of graphene oxide decreased the water contact angle by a small extent. By using the new procedure by Mg(OH)_2 nanoparticles in the presence of graphene oxide and benzyltrimethylammonium chloride we were able to achieve a

high ionic conductivity up to $15.5 \pm 1.9 \times 10^{-3} \text{ S/cm}$. The authors would like to acknowledge the financial support received in the frame of M-era.NET program (NanoEEm - Designing new renewable nano-structured electrode and membrane materials for direct alkaline ethanol fuel cell - <http://nanoelmem.fs.um.si/>, grant number C3330-17-500098).

Biography

Dr. Mojca Božič is an Assistant Professor of Materials in University of Maribor at Faculty of Mechanical Engineering in Slovenia. She has more than 13-years of experiences in the field of material chemistry (expertise in enzymatic synthesis and bio-catalysis, development of multifunctional biodegradable materials etc.) as well nanotechnology (expertise in nano-particles synthesis), and surface characterization, modification and their application. She is focusing on biochemical functionalization and cross-linking of polysaccharide with focus on chitosan and nanocellulose, and biobased-based polymers.

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