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Characterization of chitosan-graphene oxide membrane and its application in ethanol fuel cells

Graphene oxide (GO) nanoparticles were blended with environmentally-friendly polysaccharide (Chitosan) yielding the membrane for alkaline direct ethanol fuel cells (DAEFC). This type of fuel cells show high potential for applications due to their low environmental impact and high power efficiency [1]. Recently, addition of graphene impressively boosted the performance of polymer-based DAEFC [2]. Herein we present the results of structural, chemical and transport characterization of novel polysaccharide membranes, which were prepared from dispersion chitosan, and functionalized GO. Nitrogen-doped GO was investigated using XRD, XPS, FTIR, and Raman spectroscopy. We characterized membranes morphology using SEM and AFM microscopy. Ionic and electronic charge transport were studied in the direction perpendicular to the plane of the membrane, which is relevant for the DAEFC operation. Alternating current impedance spectroscopy reveals existence of two separate conductivity channels, assigned to ions and electrons. Ionic conductivity as high as 74 (± 10) mS/cm was obtained. Membranes embedded in DAEFC exhibited peak power density of 70 mW/cm^2 and an open-circuit voltage of 0.8 V. These results of ionic and electronic charge transport in GO composites will contribute to the improvement of chitosan-based DAEFCs as well as other GO-based composites.

References

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Figures

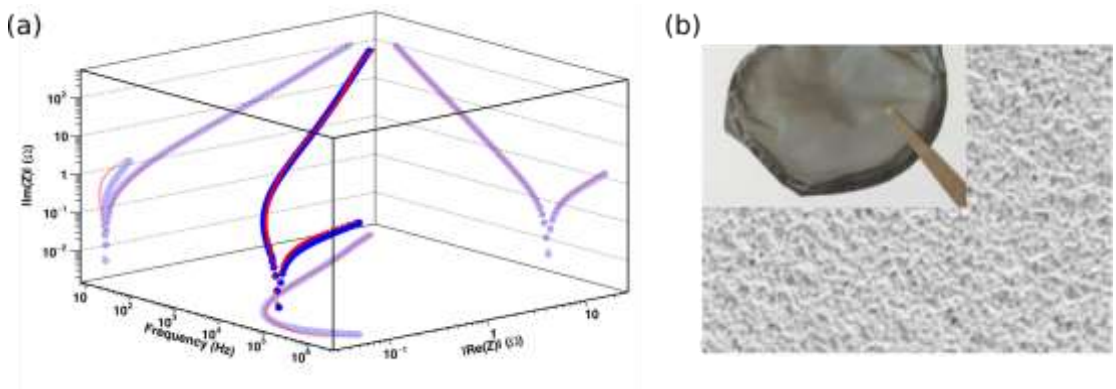

Figure 1: (a) Alternating current impedance spectroscopy of graphene oxide (GO) blended with chitosan in 6mol/L potassium hydroxide (measurement - blue, model - red). (b) SEM image of chitosan and 0.01% wt. GO membrane.