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Poster Number	Name	Session	Title
P16-ANM	Fátima C. Teixeira, António P. S. Teixeira and C. M. Rangel	ANM	SPEEK-based membranes for enhanced ion transport and chemical stability

SPEEK-based membranes for enhanced ion transport and chemical stability

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INTRODUCTION

Membranes are a key component of electrochemical devices such as fuel cells and electrolyzers. Nafion[®] membranes, considered the industry-standard benchmark, exhibits several performance limitations which has fostered research for better membranes.¹⁻³ Alternative membrane improvements are driven by the need to lower production costs and improve ion transport, chemical and thermal durability along with controlling excessive swelling and gas crossover. In this work, new membranes based on poly(etheretherketone) (SPEEK) polymer were prepared by the addition of polyvinylidene fluoride (PVDF) and the incorporation of graphene oxide with bisphosphonic acid functionalities (GOBP) as a dopant. The new membranes are characterized and their properties evaluated, showing improved proton conductivity and chemical durability.

EXPERIMENTAL

SPEEK polymer was prepared by sulfonation of PEEK with sulfuric acid.³ A sulfonation degree (DS) of 54% was determined by NMR. New membranes were prepared using a casting method from a SPEEK/DMF solution with a 1.0 wt% GOBP and 20 wt% PVDF. SPEEK modified membranes with only GOBP or only blended with PVDF were also produced and studied. The new membranes were analyzed by ATR-FTIR spectroscopy and their water uptake and swelling properties measured. Proton conductivity was evaluated by electrochemical impedance spectroscopy (EIS) from 30 to 60 °C, under 100% RH conditions, using a Solartron FRA coupled to an electrochemical interface and a BektTech conductivity cell. Chemical degradation was evaluated using H₂O₂/Fe²⁺ Fenton degradation conditions, mimicking *ex-situ* radical attack to membrane structure.

RESULTS AND DISCUSSION

New materials were characterized through different techniques to assure their functionalization. The incorporation of GOBP increases the proton conductivity up to 178 mS cm⁻¹, observed at 60 °C for 1.0 wt% dopant load. Decreases in the swelling and the water uptake values were evident, with more pronounced changes observed for the PVDF blended membranes, markedly affecting their proton conduction. Nonetheless, PVDF was found to increase the durability of the membrane when submitted to Fenton oxidation conditions. Addition of GOBP to the SPEEK/PVDF blended membrane improved the proton conductivity with similar values for water uptake and swelling.

CONCLUSION

New SPEEK membranes were prepared through the incorporation of GOBP and PVDF. Both compounds seem to contribute to the decrease in swelling and the water uptake of the hydrophilic SPEEK polymer. While GOBP increases the proton conductivity of the new membranes, PVDF has the opposite effect. The modified membranes show higher chemical stability under oxidative Fenton conditions.

REFERENCES

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