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Enhancing Conductivity in PEM Chitosan Membranes through Bisphosphonate Graphene Oxide

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Proton exchange membranes (PEM) are a key component in several electrochemical devices, such as fuel cells and electrolysers, and hold great promises for various technological applications. However, current technology is based on perfluorinated membranes which properties remain a significant challenge.[1,2] The development of alternative materials is mainly directed to using raw materials of lower manufacturing cost that may afford the required protonic conductivity.

In this study, a novel approach to improve the conductivity of chitosan membranes was used, through the incorporation of bisphosphonate graphene oxides (BPGO) as dopants. Starting from two graphene oxide materials with different oxidation levels, new BPGOs were achieved using a one-pot synthetic procedure. These dopants were characterized by ATR-FTIR and XPS spectroscopies. To improve the proton transport properties of membranes, new BPGO dopants were incorporated into the chitosan matrix, using a casting method, to achieve new chitosan doped membranes. These membranes were systematically studied to assess their proton conduction properties by electrochemical impedance spectroscopy (ESI). These membranes showed an increase in proton conduction with the rise of the temperature. The results demonstrate that the incorporation of these BPGOs dopants increase the proton conductivity of the membranes. The unique structure of BPGO, with its abundant functional groups and high specific surface area, facilitates the proton conduction of the membrane. Additionally, the presence of bisphosphonate groups improves the proton conductivity of the membrane, which increases with the increment of this functional phosphonate groups in the dopant.

Overall, this work provides valuable insights into the design of new chitosan membranes with enhanced conductivity, using different BPGOs as dopants, and lays the foundations for further research in the area of proton exchange membranes.

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1. Teixeira F.C.; de Sá A.I.; Teixeira A.P.S.; Rangel C.M. Appl. Surf. Sci. 2019, 487, 889.

2. Teixeira F.C.; de Sá A.I.; Teixeira A.P.S.; Ortiz-Martinez V.M.; Ortiz A.; Ortiz I.; Rangel CM. Int. J. Hydrogen Energy 2021, 46, 17562.