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Flexible Cellulosic Matrices for Proton Exchange Membranes Fabrication

Andreea L. Chibac-Scutaru, Madalina E. Culica, Sergiu Coseri
Polyaddition and Photochemistry Department, Petru Poni Institute of Macromolecular Chemistry, 41A Gr. Ghica Voda Alley, 700487, Iasi, Romania

Fuel cells are the subject of a global research due to the increasing demand for energy supplies, they enabling direct conversion of chemical energy into electrical energy with high efficiencies and low emissions. The proton exchange membrane (PEM) is a crucial component for fuel cell performance, and Nafion is most used PEM. Even Nafion is chemically and mechanically stable, it is expensive and is only effective (high proton conductivity) in conditions of high humidity and temperature bellow 90 °C. Researchers are concentrating on the development of novel conducting materials that can operate at temperatures exceeding 100 °C under low humidity. To achieve this objective, novel strategies have been implemented: *i)* substitution of Nafion with a natural, renewable, and pervasive polymer – cellulose; and *ii)* substitution of water with heterocyclic compounds (imidazole, 1-hydroxybenzotriazole) as conductive dopants, which assures high conductivity at temperatures >100 °C. Among cellulose derivatives, cellulose acetate is one of the most handy and cheap derivatives and offers an easy possibility of regenerating cellulose by alkaline hydrolysis. In this study, our aim is to have a complete picture of the proton conductivity of three types of cellulose matrices, in the form of films (cellulose acetate, regenerated cellulose and TEMPO-oxidized cellulose) doped with different amounts of 1-hydroxybenzotriazole, in correlation with the specific surface morphology (AFM, SEM) crystallinity and structural changes (FTIR, XRD) of the films.

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