Composite Sulfonated Polyimides With Carbon Nanotubes for Proton Exchange Membrane

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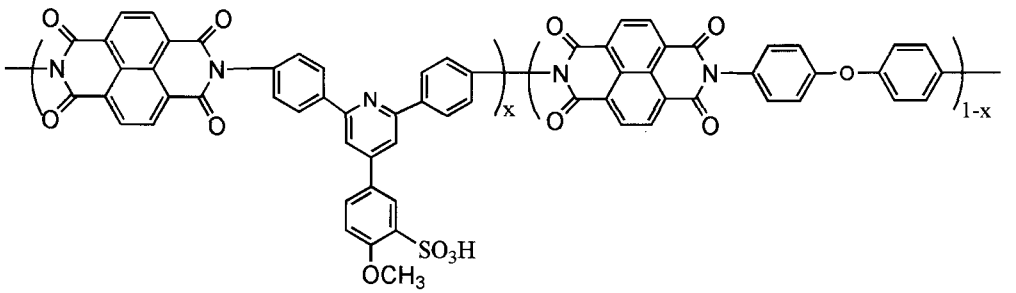
A study is presented of the characteristic of a series of nanocomposites based on sulfonated polyimide (SPI) as a matrix and functional carbon nanotubes (CNTs) as nanoadditive. The SPIs were derived from polycondensation of 1,4,5,8-naphthalene-tetracarboxylic dianhydride (NTDA), 5-(2, 6-bis(4-aminophenyl) pyridin-4-yl) -2-methoxy benzene sulfonic acid (SDAM), and 4,4'-diaminodiphenyl ether (ODA) according to our previous work (Scheme 1). The CNTs were sulfonated by a certain concentration mixture of H_2SO_4/HNO_3. Various SPI(50)-X were synthesized by control the content of CNTs, where 50 represents the degree of sulfonation (DS), and X indicated the weight percentage of CNTs and increased gradually from 0.1, 0.5 to 1%. Flexible, transparent, tough and homogeneous membranes were obtained. Comparing with the pristine films, the composite membranes showed comparable thermal stability and mechanical properties, though they became somewhat brittle. As expected, the proton conductivities of the composite SPIs were improved obviously (Fig. 1), but achieve the maximum when the weight percentage of CNTs is 0.5% as shown in Fig. 2. The SPI(50)-1% based membranes showed lower proton conductivties than that of SPI(50)-0.5% maybe due to the relative weak dispersibility when the content of the CNTs achieve a certain extent. The further work is in progress.



Scheme 1. Structure of the SPI matrix.

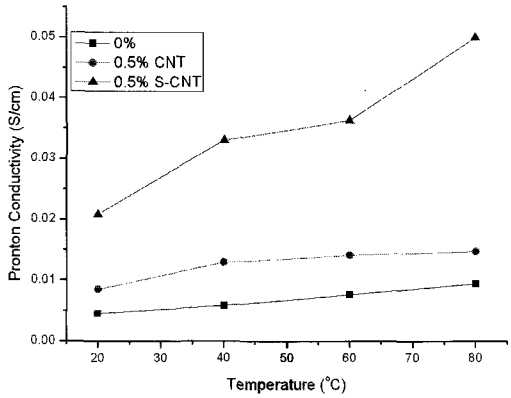


Figure 1. Proton conductivities of composite SPI (50)-0.5% at different temperatures. (S-CNT represent the sulfonated CNT)

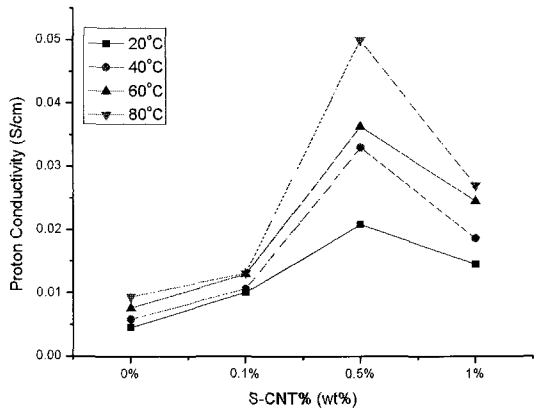


Figure 2. Proton conductivities of various composite SPI(50) membranes with different content of sulfnated CNT at different temperature.

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