

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Magnetism, NMR spectra, and optical transformations in Nafion with paramagnetic nano-structure E.M. LEVIN, Ames Lab and Dept. of Physics and Astronomy, Iowa State Univ. (ISU), Q. CHEN, Ames Lab and Dept. of Chemistry, ISU, S.L. BUD'KO, Ames Lab and Dept. of Physics and Astronomy, ISU, K. SCHMIDT-ROHR, Ames Lab and Dept. of Chemistry, ISU — The bulk magnetization and the ^{19}F NMR spectra of the ionomer Nafion as-received and doped with Mn^{2+} , Co^{2+} , Fe^{2+} , and Fe^{3+} paramagnetic ions have been studied, with and without treatment in 1H-1,2,4-triazole. As-received Nafion is diamagnetic at 300 K but below 10 K it shows a small paramagnetic “tail” indicating the presence of a small amount of paramagnetic centers. Nafion doped with Mn, Co, and Fe ions shows clear paramagnetic behavior at 300 K, which depends on the type and amount of doping ion and treatment in triazole. ^{19}F NMR spectra at 13 kHz magic angle spinning show differential increases in linewidth and spinning sidebands intensities. The observed changes in magnetism are determined by the spin state of the paramagnetic ions, while NMR reflects dipole-dipole and Fermi contact interactions between them and nearby fluorines of Nafion. Doping of Nafion with Fe and Co and treatment in triazole can strongly affect its color. The most pronounced effect is the temperature- induced reversible transformation of colorless Nafion to violet (Fe doped) and the reverse phenomenon (Co doped) observed simultaneously with the magnetic transformation just below room temperature. All observed phenomena are discussed in terms of the paramagnetic ions in the nano- structure of the Nafion matrix.

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Date submitted: 21 Dec 2004

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