# Multiple Quantum Filtered NMR Analysis of Various Nafion Fuel Cell Membranes at Room Temperature

Alyxandra Aarbo, Wesley Verbeek, Kristopher Ooms*

*The King's University College*

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$^2$H zero and double quantum filtered NMR techniques were used to study the $D_2O$ environments in four different Nafion membranes, including a cast membrane, reinforced membranes and membranes with different thickness. Analysis of the spectra allows for residual quadrupolar coupling constants and $T_2$ relaxation times to be obtained as a function of membrane hydration and compared to the previously reported Nafion N117 membrane. Of particular interest are the cast and reinforced membranes, NR212 and HP, respectively. Both membranes had residual quadrupolar couplings that were lower than those observed in the N117 membrane. This suggests that water molecules in these membranes experience less restricted motion than in N117 at the same hydration. The $T_2$ relaxation times of the NR212 membrane were higher than those seen in N117, ranging from 335 ms to 15 ms. The $T_2$ relaxation times of the Nafion HP membrane, which ranged from 55 to 7 ms, were slightly lower than those found in N117 and NR212. These variations in relaxation indicate that water exchange dynamics are affected by the reinforcement and membrane preparation method.