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Proton dynamics of triethylammonium triflate probed by neutrons

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Protic ionic liquids are an important group of molten salts, which can form a hydrogen-bond network with proton-donor and proton-acceptor sites. The knowledge about their proton transport properties is crucial for a variety of electrochemical applications. Neutron scattering techniques are sensitive to the presence of hydrogen atoms and thus can provide useful information about proton dynamics in a sample. Here we report both elastic scans measurements and QENS-experiments on a protic ionic liquid (triethylammonium triflate, [NH(C2H5)3][CF3SO3]) performed on the IN10 and IN5 spectrometers at ILL and FOCUS at SINQ on different time-scales by choosing the corresponding linewidth of the resolution function. The temperature range considered during the experiments (2-440 K) encompasses the regions where the sample undergoes several phase transitions with the corresponding changes in the global and localized dynamics of the cation. At higher temperatures all the following types of motions contribute to the quasielastic broadening: long-range ion diffusion, diffusion in a cage formed by the neighboring particles, ethyl groups librations, etc.; they are gradually switched off with the temperature decrease. In order to separate the motions of the cation as a whole and localized dynamics of the side chains a sample with the deuterated ethyl-groups was investigated as well.

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