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Recent applications of neutron backscattering spectroscopy at ANSTO

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The Emu μeV-resolution spectrometer is operated by ACNS at OPAL since 2016. The spectrometer enables measurements at correlation times from tens of ps to a few ns, as enabled by its Si(111) crystal backscattering setup and a Doppler drive offsetting incident energy by a few 10μeV. Current momentum transfer range is from 0.27 to 1.8 Å^-1.
Quasielastic neutron scattering (QENS) investigations in organic matter make up the bulk of applications on Emu, while nuclear hyperfine splitting and quantum rotational tunneling studies are also possible.
A few examples from biophysics and polymer science will be presented [1-4]. There is as well growing interest in understanding transport-related diffusion in ionic conductors and catalytic materials [5,6]. Further to fully-fledged QENS studies, elastic- and inelastic- fixed window scans add versatility to backscattering spectroscopy, as further illustrated by recent high impact studies [7,8].

[1] A Yamaguchi et al, “Quasielastic Neutron Scattering Study on Low-Hydrated Myoglobin inside Silica Nanopores”, Coll Surf A 698 (2024) 134559
[2] Y Ye et al, “Dynamic entity formed by protein and its hydration water”, Phys Rev Research (2024) accepted
[3] KJ Bichler et al, “Position-Dependent Segmental Relaxation in Bottlebrush Polymers”, Macromolecules 57 (2024) 4729
[4] S Kim et al, “QENS study on local segmental dynamics of polyelectrolytes in complex coacervates”, Polymer 264 (2023) 125525
[5] EA Cheung et al, “Structure and dynamics in Mg2+-stabilized γ-Na3PO4”, J Am Chem Soc 143 2021 17079
[6] V Skukauskas et al, “Probing the dynamics of methanol in copper-loaded zeolites via quasi-elastic and inelastic neutron scattering”, Front Chem Sci Eng (2024) in press
[7] T Kikuchi et al, “Detailed dynamical features of the slow hydration water in the vicinity of poly (ethylene oxide) chains”, J Chem Phys 160 (2024) 064902
[8] S Zheng et al, “Colossal electrocaloric effect in an interface-augmented ferroelectric polymer”, Science 282 (2023) 1020

Topics

Biological Systems and Soft Matter

Primary author(s) : DE SOUZA, Nicolas (ANSTO - Australian Centre for Neutron Scattering); KLAPPROTH, Alice (ANSTO)

Presenter(s) : DE SOUZA, Nicolas (ANSTO - Australian Centre for Neutron Scattering)

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