

50 Years of Neutron Backscattering Spectroscopy



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Polymer Dynamics: Highlights from Neutron Backscattering Spectroscopy

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A polymer is a condensed matter system where the structural units are macromolecules –big molecules built up by repetition of a more or less simple chemical motif (monomer) mainly based on carbon and hydrogen atoms. Polymers display rich and complex dynamics, including different atomic and molecular processes, which spread over very different time and length scales. On the one hand, polymers are considered canonical glass-formers, thereby showing the typical dynamic processes of this broad class of systems (anomalous vibrations, local relaxations, secondary β -process and the so-called α -relaxation). On the other hand, polymers also show unique large-scale dynamic processes that are related to their macromolecular nature. Neutron backscattering spectroscopy has contributed to unveil many important aspects of these dynamical processes. Some of them will be highlighted in this talk: (i) resolving the ‘mystery’ of methyl group tunneling in polymers and glasses; (ii) molecular interpretation of the γ -relaxation in engineering thermoplastics; (iii) correlation between non-Debye behavior and Q-behavior of the α -relaxation in glass-forming polymers; (iv) deducing the ‘Rouse rate’ from low-Q incoherent scattering in polymers and nanocomposites. New applications in the field of complex materials based on polymers are also envisaged.

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