

DYNAMIC SMALL ANGLE SCATTERING WITH COHERENT X-RAYS

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Complex relaxations in disordered systems have been studied successfully by scattering of both visible light and neutrons. Neutron based techniques can probe the dynamic properties of matter at high frequencies from ω typically equal to 10^{14} Hz down to about 10^7 Hz and achieve atomic resolution. Photon Correlation Spectroscopy (PCS) with visible light can cover low frequency dynamics ($\omega < 10^6$ Hz), but probes only the long wavelength $Q < 4 \cdot 10^{-3} \text{ \AA}^{-1}$ region in materials not absorbing visible light. Coherent x-ray beams from third generation synchrotron radiation sources provide the possibility for correlation spectroscopy experiments with coherent x-rays (XPCS) capable of probing the low frequency dynamics (10^6 Hz to 10^{-3} Hz) in a Q range from $1 \cdot 10^{-3} \text{ \AA}^{-1}$ up to several \AA^{-1} . XPCS can thus provide atomic resolution, but has proven to be particularly powerful in the small angle scattering regime and for the study of complex fluids. XPCS can operate in optically opaque materials and is not subject to multiple-scattering effects. We will review the status of XPCS in the SAXS regime by discussing the properties of static x-ray speckle as well as its applications for the study of dynamical phenomena in soft condensed matter systems (suspensions of colloidal particles, polymer micelles, surface dynamics on complex liquids).