Nuclear Resonance Scattering of synchrotron radiation for physics and chemistry of electronic materials

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Nuclear resonance scattering of synchrotron radiation is a well-established experimental process that combines hyperfine spectroscopy and phonon spectroscopy with the advantages of synchrotron radiation (high brilliance, variable energy, focusing).

Hyperfine spectroscopy provides information on the oxidation state, the local coordination, and (potentially) the magnetic state, whereas phonon spectroscopy allows for a complete lattice dynamics and thermodynamic characterization.

So far, the Nuclear Resonance beamline ID18 at ESRF [1] served users successfully for decades with a typical beam size of about 10 μm and a typical energy resolution of about 0.5 meV (or in a special mode down to ~10 neV).

In the frames of the Extremely Brilliant Source upgrade programme of the European Synchrotron Radiation Facility a new nuclear resonance scattering beamline is emerging (ID14) that is expected to cater the users with an improvement both in the beamsize and in the energy resolution by about an order of magnitude, come to a beamsize of about 200 nm or a typical energy resolution of about 50 – 100 μeV. Moreover, for specific applications the photon flux is also expected to improve by an order of magnitude.

In this talk a brief general overview of the basics in nuclear resonance scattering will be provided, an outlook of the new instrumentation will be given, characteristic examples will be presented, and discussions for future scientific collaborations will be initiated.

1. R. Ruffer and A.I. Chumakov, Hyperfine Interact. 97-98, 589 (1996).