EXAFS for Disordered Matter: an “Old” Probe for “New” Investigations

S. DE PANFILIS

Research Centre SOFT, INFM-CNR, Dipartimento di Fisica, University “La Sapienza”, Roma, Italy, and Museo Storico della Fisica e Centro Studi e Ricerche “Enrico Fermi”, Roma, Italy.

Extended x-ray absorption fine structure (EXAFS) spectroscopy exploits the quantum interference resulting from the scattering of a photoelectron, excited from a core level, by the potential of the surrounding atoms. The interference pattern carry information on the local atomic distribution around the photoabsorbing species. This spectroscopy therefore possess a unique capability as a local structural probe in condensed matter, and it is specifically suited for investigating the average atomic arrangement in disordered materials, being independent of the long-range correlations .

Since the early 70's (often quoted as the beginning of the *modern EXAFS age* [1]), the technique was applied in a number of different systems and demonstrated to provide a unique sensitivity to the short-range order details of the structural parameters (see [2] for a rather exhaustive review). Since those early applications, we have seen substantial developments in the experimental techniques, as well as in the theoretical and data-analysis frameworks, which nowadays allow scientists to perform EXAFS experiments under environmental conditions of pressure and temperature that were not conceivable only few years ago.

The newly developed experimental techniques have been applied to study liquid and amorphous matter under extreme conditions, including metals, semiconductors, molecular or ionic fluids and solutions, as a function of pressure and temperature. We will present an overview of the current state-of-the-art results and a description of the experimental apparatus used at a third generation synchrotron radiation EXAFS beamline. We will also discuss the complementarity of this spectroscopic technique with respect to scattering ones.

References

[1] – D.E. Sayers, E.A. Stern and F.W. Lytle, Phys. Rev. Lett. 27, 1204 (1971).
[2] – A. Filipponi, J. Phys.: Condens. Matter 13, R23, (2001).