Applications of constant velocity mode Mössbauer effect experiments

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The constant velocity (fixed energy) mode in Mössbauer effect experiments has its origin with the discovery of the Mössbauer effect. In fact the first experiment in 1958 by Rudolf Mössbauer was at fixed relative velocity. However, this methodology was left behind with the implementation of periodic and variable velocity modes that allow the acquisition of Mössbauer effect spectra over wide and uniformly varying energy ranges. However, constant velocity experiments were successfully used in some studies, mainly to determine structural or magnetic ordering temperatures.

This talk will be devoted to the developments and applications that emerged in the working group of the Universidad Nacional de La Plata in Argentine, during the 2000s on the constant velocity mode for Mössbauer spectroscopy. The evolution of the developed equipment and measurement modes will be presented from a chronological point of view, emphasizing the motivations behind the proposed modifications.

Different examples of applications of the proposed and incorporated methodologies will be presented. Such as the determination of ordering temperatures, monitoring continuous temperature variation of hyperfine interaction parameters, kinetics in nano-crystallization of metallic amorphous alloys and magnetic low frequency response of atomic moment orientations. In addition, the potential of new measurement strategies associated with the real-time handling of the velocity waveform and amplitude will be discussed. This is illustrated by spectral region-of-interest tracking involving structural phase transitions and electronic spin transitions. Finally, there will be discussion on how periodic sample perturbations can be studied through constant velocity experiments.

BIO

Dr Gustavo Pasquevich is at the Universidad Nacional de La Plata (in La Plata near Buenos Aires). He is based in the Group of Magnetism and Magnetic Materials (G3M) at the Instituto de Física La Plata, and is a researcher with the National Scientific and Technical Research Council (CONICET). His current project at CONICET involves magnetic nanoparticles and nanocomposites, namely, ferrofluids and magneto-mechanical stimuli promotors of technological interest and in medical applications. He previously did post-doctoral work in Spain and at UNLP in these research areas. He also has major involvement in the Mössbauer effect laboratory at UNLP. There he has helped to develop and commission modules for rapid data acquisition or region-of-interest scans to identify magnetic phase transitions or to monitor process kinetics in a variety of Fe based materials.