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Simulation of ERDA measurements for nanostructured materials

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Different ion scattering techniques with high-energy resolution have a great potentiality to investigate nanostructured systems since the energy loss of scattered ions depends on the set path lengths probed by the ions at different incident and detection angles. In the case of MEIS (Medium Energy Ion Scattering) this is accomplished by simulations through the use of PowerMeis software [1], that considers any geometry, size distribution, composition and density of the nanostructures [2]. Recently not only the scattering of the incident ions has been measured but also the energy loss of the recoil atoms using electrostatic analysers [3] and time-of-flight (TOF) detectors [4,5]. These high-resolution ERDA (Elastic Recoil Detection Analysis) measurements performed at low energies in MEIS apparatus, are accomplished by using heavier than He incident ions with grazing angles. They complement the backscattering analysis by allowing for the detection of lighter atoms. However, in order to better understand the ERDA spectra, especially in the case of nanostructures, computational simulations that include multiple and plural scattering effects are of major importance. In this work, we include elastic recoil effects in the PowerMeis software, allowing for the simulation of both MEIS and ERDA spectra simultaneously. Spectra acquired by a TOF system [5] using 100 keV Ne+ beams are discussed for uniform and nanostructured films. In particular the importance of multiple and plural scattering effects are analyzed and set a limit for the use of the ERDA technique at low energies.

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