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Simulation of ion backscattering from rough thin films

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Depth profiling and morphological characterization of thin film is of critical importance to a wide variety of modern technologies. Back scattering spectroscopy using MeV ion beams is considered as a powerful method for depth profiling elements in the near surface layer of solids. Generally, this technique is a one-dimensional method and the roughness and inhomogeneity of the target often is not considered. In the present work, influence of the surface roughness on back scattering spectra was studied. The back-scattering spectra from the different rough thin films, were studied with Monte-Carlo simulation and analytical solution.
The back-scattering spectra were simulated using the GEANT4 Simulation code by simulating the details of the particles trajectory as well as multiple and plural scattering of in-going primary ions and out-coming backscattered ones. All simulations were performed at the different incident and back-scattering angels.
The results of the simulations and analytical approximation of the back-scattering spectra show substantial changes in shape and amplitude as a function of surface roughness at the different incident and detection angels. Also effects due to the detector solid angle, beam spot size, multiple and plural scattering of incoming and outgoing beam were studied.

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