Model independent approach for the analysis of GIXR data from thin films.

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The main limitation in the analysis of thin films by means of grazing incidence X-ray reflectivity (GIXR) technique is that direct reconstruction of their optical constant profile from measured data is impossible because the phase of reflection is not known and the limited measurement range. The only way to analyze the GIXR data is to fit a calculated reflectivity curve to a measured one by varying parameters of a model of a thin film. In many cases the initial model does not take into account specifics of the analyzed samples, for example, the possibility of a density gradient inside a layer or formation of compound layers on the interfaces. In these cases accuracy of the GIXR data analysis will be limited by assumptions of the initial model what can be significantly less accurate than the actual accuracy defined by the data. We developed an assumption independent approach for the analysis of GIXR data from a thin film structure where the film is presented as a set of ultra-thin sublayers. Then we define a set of optical constants that are possible for a such sample and parameterize each optical constant with the digital array such that one number uniquely defines real and imaginary part of optical constant possible for such film. The minimization routine is used to fit the most optimal optical constant profile. In this approach a program is free to form any possible gradients and shapes of the interfaces using sets of physical possible material combinations.