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Investigating the Structures of Thin Films and Multilayered Materials by Neutron Reflectometry. C.F. Majkrzak, NIST Center for Neutron Research, Gaithersburg, MD 20899-8562.

With both isotopic and magnetic sensitivity, neutron reflectometry has become an established technique for studying the nanometer scale structure of thin films and multilayered matter. From measurements of the intensity of specularly reflected neutrons, the depth profile of the scattering length density (SLD), and ultimately information about the chemical composition, along the surface normal can be deduced whereas nonspecular reflection reveals in-plane density variations. Specular neutron reflection with polarized beams yields the *vector* magnetization depth profile. Polarized neutron reflectometry studies of synthetically grown sandwiches and superlattices of magnetic layers interspersed with materials possessing other physical properties, such as superconductivity, have proven to be particularly powerful. Furthermore, with the development of exact methods for phase determination employing adjacent references, dynamical specular neutron reflection data can be directly inverted to obtain, in principle, and largely in practice, a unique SLD profile. An introduction to the basic theory and experimental methods of neutron reflectometry, together with a sampling of typical current applications in several different fields, is presented. In conclusion, the bright outlook for future advances in neutron reflectometry is considered.