

X-ray reflectivity at the L edges of Gd

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X-ray scattering is a powerful probe of buried interface structures. A natural extension to the conventional x-ray study of the roughness arising from charge scattering, involves the characterization of in-plane and vertical roughness correlations of magnetic interfaces. Preliminary successes using magnetic resonant scattering at the L edges of 3d transition metals have been reported using circularly polarized soft x-rays. We propose to extend these measurements into the hard x-ray region working at the L edges of 4f rare-earths. The larger region in 2-d reciprocal space available with hard x-rays will enable a more thorough determination of the roughness parameters. In a preliminary experiment to study the x-ray charge scattering at the L absorption edge of Gd, we have made reflectivity measurements on a 70 Å thin film sample. Using the off-edge specular reflectivity profile, we determined the structural roughness and thickness parameters using calculated optical constants. Using these obtained structural parameters, on-edge reflectivity profiles are then used to determine the less well-known on-edge optical constants. Precise knowledge of these optical constants are necessary to obtain the magnetic reflectivity from which the asymmetry ratio, $R=(I(+)-I(-))/(I(+)+I(-))$, is determined. Further, these experimentally determined on-edge optical constants can be compared to recent theoretical calculations.