Resonant x-ray reflectivity studies of Fe/Cr interfaces*

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We have measured the interfacial profiles in Fe/Cr superlattices by resonant x-ray reflectivity. Fe/Cr (001) and (112) superlattices were epitaxially grown by magnetron sputtering onto single-crystal MgO (001) and (011) substrates, respectively. The two orientations were grown simultaneously which allows a direct comparison of the interfacial profiles for different crystallographic orientations. Resonant reflectivity measurements were carried out by tuning the x-ray energy around the respective K-edges of Fe and Cr. We then self consistently fit all data sets to the same structural model to determine not only the electron density profiles but also the compositional profiles. Such information is normally difficult to obtain in reflectivity measurements due to the low contrast between Fe and Cr. The results are compared to similar experiments on Cr films grown by molecular beam epitaxy onto the (001) surface of a Fe whisker. Fe whiskers are atomically smooth over lateral length scales greater than 1 mm and provide a nearly perfect substrate for the study of Cr growth on Fe.

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