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X-ray reflectivity study of semiconductor interfaces

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We report here the results of a x-ray reflectivity study of AlAs/AlGaAs multilayers and Ge-Si-Ge trilayers grown using metal organic vapour phase epitaxy (MOVPE) and ion beam sputtering deposition techniques, respectively. Interfaces present in these materials play a very important role in determining the physical properties. X-ray reflectivity techniques provide interesting information for rapid completion of the growth-characterization-growth cycle in the development of these technologically impotant materials. We find that, in general, the two different types of interfaces present in these multilayer systems are very different.

In the case of Ge-Si-Ge trilayers, we could extract a compositional profile as a function of depth from the reflectivity data. We observe that, although the interface formed by Si over Ge is sharp, a Si(0.4)Ge(0.6) alloy is formed at the interface when Ge is deposited over the Si layer.

A 16 bilayer AlAs/AlGaAs film was grown to obatin a Bragg mirror. X-ray reflectivity studies of such thick multilayers, having bilayer thickness of ~1000 Angstrom and suitable for optoelectronics applications, require special attention in data collection and analysis. Availability of intense photons at third-generation synchrotron sources will be very useful for characterizing these multilayer devices.