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Hydrogen Annealing of Epitaxial Niobium Films on Sapphire*,**

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High-resolution X-ray scattering studies of niobium [10] films grown by molecular beam epitaxy on sapphire [11$\bar{2}$0] substrates have revealed novel structural features. In transverse scans of the out-of-plane Nb (110) Bragg peak we find two components, the sharper of which implies mosaicities an order of magnitude better than bulk single crystal Nb. The planes associated with the sharp component are aligned with the sapphire (11$\bar{2}$0) planes.

Upon hydrogen loading of the Nb film, we find evidence for a dramatic increase of the lateral coherence length. It appears that the addition of hydrogen may allow defects to move to the film boundary, removing inhomogeneous strain and thus improving the epitaxial film quality by acting as a very effective "cold-annealing" agent.

1. Introduction

The advent of thin-film growth technologies within the last decade has broadened the horizons of metal physics. The ability to produce well-ordered films is key to many of these new areas: surface physics has benefitted from the ease of producing high quality surfaces which are difficult or impossible to prepare on bulk samples. The area of magnetism in thin films is presently under intense investigation. Niobium is one material in wide use as a buffer layer, and the quality of the Nb film will limit

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