3-D Atomic-Scale Analysis of Thin Film Materials: Progress and Future Prospects

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Currently, the only technique capable of microanalysis with nanometre resolution in all 3 dimensions is the 3-dimensional atom probe (3DAP). This instrument has provided extremely fine-scale information on the chemistry of metallic alloys, but its application to thin films has been limited because of the requirement of a sharply-pointed needle specimen. Recently, however, we have used a combination of photolithography and focussed ion beam milling to fabricate atom probe specimens from copper-cobalt multilayer films grown on flat substrates. This has permitted 3-dimensional atomic-scale observations of layer curvature and interconnectivity in these films for the first time, and correlation of these features with the magnetic properties of the film.

In order to extend the applicability of atom probe analysis further into thin film materials and devices, we are currently developing a new instrument, called the scanning atom probe (SAP). Specimens for this instrument will be microtips formed within the surface of a material by a combination of masking and ion-beam milling, such that the apex of the microtips (which represents the information volume of the instrument) lie close to the original sample surface. A local electrode is moved above one of the microtips to select it for atom probe analysis. This paper will discuss the prospects and progress for this new instrument.

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