

- [54] SPUTTER DEPOSITION FOR MULTI-COMPONENT THIN FILMS
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[57] ABSTRACT

Ion beam sputter-induced deposition using a single ion

beam and a multicomponent target is capable of reproducibly producing thin films of arbitrary composition, including those which are close to stoichiometry. Using a quartz crystal deposition monitor and a computer controlled, well-focused ion beam, this sputter-deposition approach is capable of producing metal oxide superconductors and semiconductors of the superlattice type such as GaAs-AlGaAs as well as layered metal/oxide/semiconductor/superconductor structures. By programming the dwell time for each target according to the known sputtering yield and desired layer thickness for each material, it is possible to deposit composite films from a well-controlled sub-monolayer up to thicknesses determined only by the available deposition time. In one embodiment, an ion beam is sequentially directed via a set of X-Y electrostatic deflection plates onto three or more different element or compound targets which are constituents of the desired film. In another embodiment, the ion beam is directed through an aperture in the deposition plate and is displaced under computer control to provide a high degree of control over the deposited layer. In yet another embodiment, a single fixed ion beam is directed onto a plurality of sputter targets in a sequential manner where the targets are each moved in alignment with the beam under computer control in forming a multilayer thin film. This controlled sputter-deposition approach may also be used with laser and electron beams.

20 Claims, 4 Drawing Sheets

