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SOLID STATE DIFFUSION OF Sn IN POLYCRYSTALLINE Al FILMS

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The formation of a wetting layer of Sn and the Stranski-Krastanov growth of Sn on a polycrystalline Al film surface has been proved recently [1]. In the present experiments the influence of Sn on the structure evolution of Al films has been analysed in detail.

The films were prepared in HV both by thermal evaporation and magnetron sputtering at 160⁰C substrate temperature on Si wafers covered by a thermally grown oxide. Al and Sn were either sequentially evaporated from thermally heated W sources or sequentially sputtered from a 100 mm diam. DC magnetron target. The samples consisted of an Al base layer (500 nm), a Sn interlayer (10 nm) and an Al capping layer (500 nm) and were investigated by analytical and high resolution X-TEM, AFM and scanning AES.

In all cases the grain growth in the Al capping layer is promoted by the presence of the Sn interlayer in comparison to the base layer as confirmed by X-TEM and AFM. The sputter deposited capping layers contain intragranular line-like features roughly parallel to the substrate plane. Microanalysis shows the presence of Sn in the capping layer and indicates that Sn is associated with these linear features.

The promotion of grain growth in the capping layer can be attributed to the permanent transport of Sn to the growth front via grain boundaries which was confirmed by dynamic scanning AES-measurements. The linear intragranular features formation is explained by the oxidation of Sn on the free surface due to the residual oxygen present in the background gas.

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References:

[1] C.Eisenmenger-Sittner et. al, Surf. Sci., 489 (2001), 161