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Co-depositing Sn controls the growth of Al films as surfactant

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Earlier experiments of the authors indicated that co-deposited Sn promotes the grain growth of Al films and decreases the effect of environmental oxygen on the structure evolution. The present study investigates the influence of co-deposited Sn on the atomic processes involved in the structure evolution of vapour-deposited Al films.
The films were prepared in HV by thermal evaporation from W sources at 160^0C substrate temperature either on Si wafers covered by a thermally grown oxide or on air cleaved mica. By applying the half-shadow technique, pure and Sn-doped Al films could be deposited simultaneously. The samples were investigated by AFM, scanning AES, X-TEM as well as by X-ray diffraction methods.
The grain growth of Al is promoted by Sn in all stages of the film formation. Scanning AES measurements prove the existence of a wetting Sn layer both on the surface of Al islands and on the surface of the continuos Al layer. Excess Sn forms islands on the growth surface. The surface of pure Al layers exhibits grain boundary grooves and bunches of growth steps around terraces, while that of the Sn doped layers is more rounded. The substrate-film interface was covered by a thin Sn layer. AES measurements also prove the presence of Sn on the growth surface of Al films even after termination of Sn addition.
Results of these experiments indicate that during co-deposition of Al and Sn the impinging Al atoms penetrate the wetting layer and are incorporated into the already existing Al crystals. A model has been developed for describing the growth of Al crystals in the presence Sn.

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