

Growth of samarium thin films and subsequent oxidation on polycrystalline copper

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The growth of samaria thin films on copper sheets has been chemically studied by *in situ* X-ray photoelectron spectroscopy (XPS). The early stages of growth (0.1-14 ML) were studied by consecutive evaporations of Sm by chemical vapor deposition followed by XPS measurements. Subsequently, samaria films of different thicknesses, namely 0.1, 1, and 14 ML, were oxidized at room temperature (RT). The evolution of the sample morphology was determined through inelastic peak shape analysis (IPSA) using the QUASES™ software as an indirect method to study the relationship between Sm oxidation state and its surface arrangement.

Our results show that samarium grows as 2D islands up to 2ML, which is followed by 3D growth. Chemical analysis indicates that at low coverages (<0.5ML) Sm is already oxidized, leading to the appearance of Sm³⁺ as the only oxidation state. The increase in the intensity of the O1s peak with time and the absence of spectral changes in the Cu2p and LMM Auger (substrate) indicate that the transformation is mainly due to adventitious oxidation of the layer. With further deposition at RT the metallic state Sm⁰ appears at higher coverages, which is readily postoxidized by subsequent exposure to molecular oxygen, leading to complete oxidation. No intermediate oxidation states (Sm²⁺) were observed, in contrast to the reported prevalence of Sm²⁺ on single crystal surfaces during the early stages of growth [1].

References:

[1] Nakayama et. al., Surface Science 600(12):2403-2410

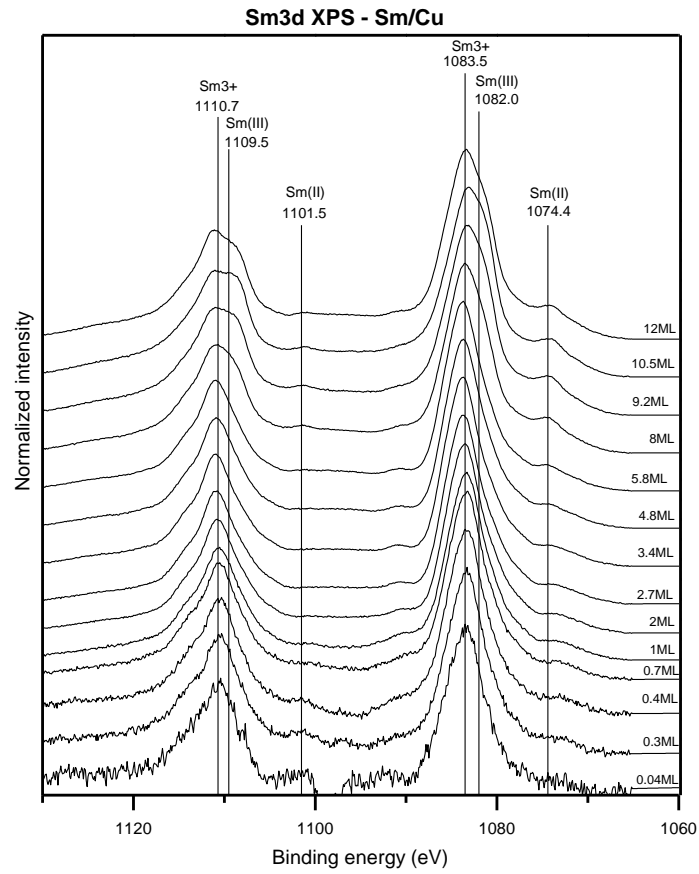


Fig. 1. Evolution of Sm3d spectra during Sm deposition.

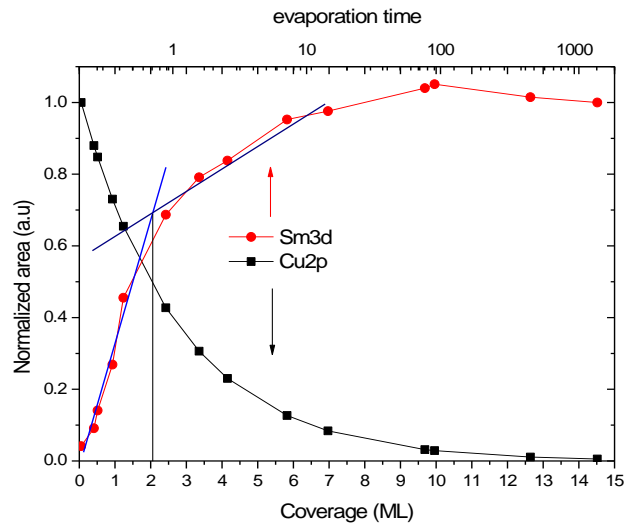


Fig. 2. Evaporation curve of Sm on Cu foil.