Creation and analysis of well ordered transition metal oxide films grown on $Cu_3Au(001)$

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Abstract:
Well-defined oxide substrates are an urgently prerequisite in order to study catalytic reactions. The recently introduced CAOS[1)] method turned out to be well suited for preparation of ordered two dimensional thin oxide layers on a metallic surfaces. The initial growth of such thin metal oxide layers have been investigated by prominent surface science techniques among them in particular microscopy on an atomic scale (STM). The formation of Vanadium, Niobium and Molybdenum oxides will be discussed. First a thin oxygen layer has been formed at a $Cu_3Au(001)$ substrate (CAOS) which acts positively in two ways: firstly, it prevents completely the alloy formation, secondly, a strong surface wetting of an amorphous Vanadium oxide precurser occurs. Moderate post annealing results in 2D growth of ordered oxide layers in particular $V_2O_3(0001)$ on $Cu_3Au(001)$ with good quality..
Not only the topmost surface layer but also the heterointerfaces between oxides and metals are of wide-ranging importance and not well experimentally elucidated yet. High resolution transmission electron microscopy (HRTEM) with spherical aberration (Cs) image correction has been used to unravel the metal-oxide interface on an atomic scale. The interface characterization of the thin two-dimensional monocrystalline film of $V_2O_3(0001)$ grown on a $Cu_3Au(001)$ sample will be addressed in detail. At the interface an extra vanadium monolayer is introduced between the part of the Cu_3Au substrate and the oxide layer. The location of the extra vanadium is not related with the V_2O_3 crystallography but instead connected to the $Cu_3Au(001)$ metal side. The oxide layer ends at the interface with the quasi-hexagonal close packed oxygen layer of bulk truncated $V_2O_3(0001)$. The stacking sequence of oxygen columns follows visibly the vanadium oxide part and is directionally decoupled from the $Cu_3Au(001)$-V region.

[1)] **C**u_3**A**u **O**xygen **S**ubstrate

2) H. Niehus, H.A. Calderon, B. Freitag, F. Stavale, C.A. Achete, Surf. Sci. (2008)