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EPITAXIAL HIGH-ENTROPY ALLOY THIN FILMS FOR SURFACE INVESTIGATIONS

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High-entropy alloys (HEAs) have attracted attention for a variety of applications. Among them are their application as structural materials, for radiation-exposed building parts in nuclear reactors as well as in the form of wear and corrosion protection layers. More recently they have also been proposed as effective electrocatalysts [1]. However, although the surface properties of HEAs play a central role for corrosion protection and catalysis, they are still largely unexplored. In particular, fundamental model studies of single-crystalline low-index surfaces of HEAs are extremely scarce [2,3]. This is - at least to a certain extend - caused by the unavailability of single-crystalline samples. One possibility to overcome this bottleneck is to use epitaxial films grown on single-crystalline substrates [4,5].
This presentation will summarize our recent work on the growth and subsequent characterization of epitaxial CoCrFeNi films. The films were deposited by DC magnetron sputtering from spark-plasma sintered targets [6] onto single-crystalline oxide substrates. X-ray diffraction (XRD), scanning electron and transmission electron microscopy (SEM, TEM) and energy-dispersive X-ray spectroscopy (EDX) were employed to study the bulk properties of the deposited films. It was observed that face-centered cubic CoCrFeNi films grow epitaxially on MgO(100) and Al_2O_3(0001) substrates, exposing low-index (100) and (111) surfaces, respectively. A characterization of the surfaces was performed using X-ray photoelectron spectroscopy (XPS), angle-resolved photoelectron spectroscopy (ARPES), low-energy electron diffraction (LEED) and, more recently, scanning tunneling microscopy (STM). From these studies it can be concluded that epitaxially grown HEA films have the potential to fill the sample gap, allowing for fundamental studies of properties of and processes on well-defined HEA surfaces.

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