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Exploring the synthesis of a C-Cu-Mo-Ti-Ta Multi-Elemental Alloy/High-Entropy Alloy, through DC magnetron sputtering

High Entropy Alloys, HEA, since their introduction in 2004 by Yeh and Cantor have been seen to have superior properties to conventional metallic alloys. In recent years efforts have been made to develop HEAs with beneficial properties for the industry. For example, increased hardness, wear, and temperature resistance. In the present work, we studied the synthesis of a Multi-Elemental Alloy, MEA/High Entropy Alloy, HEA, of CCuMoTiTa deposited using the DC magnetron sputtering technique. A HEA with these materials has not been reported in the literature, therefore, it is expected that it might have new and different properties. The synthesis was carried out by adding small pieces of the different elements onto the racetrack of a 4"Ti target. After deposition, the films were annealed for one hour at 800℃ using an Annealsys Rapid Thermal Processing (RTP) system. The samples were characterized by RAMAN spectroscopy, Rutherford Backscattering Spectrometry (RBS), X-ray photoelectron spectroscopy (XPS), Scratch testing, and X-ray diffraction (XRD). The XRD and RAMAN measurements showed that the films had a crystalline structure, before and after annealing. In addition, they contained a mixture of oxides, mostly rutile. With XPS, the bonding of most elements with oxygen atoms was observed. The composition was studied using the RBS technique with a 1.5 MeV protons beam. Finally, with the Scratch testing, the critical loads, Lc1 and Lc2, of the deposited films before annealing were determined.

Keywords

Multi-Elemental Alloy, HEA, Sputtering deposition, HEA XPS

Reference

Yeh et al. Nanostructured High-Entropy Alloys with Multiple Principal Elements: Novel Alloy Design Concepts and Outcomes. Advanced Engineering Materials. 2004. https://doi.org/10.1002/adem.200300567

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