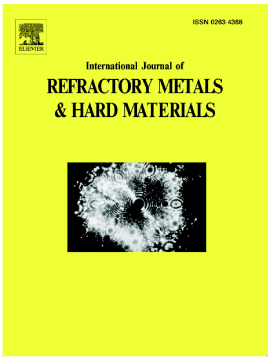

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High-throughput study of binary thin film tungsten alloys

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Abstract

Combinatorial magnetron co-sputtering from elemental sources was applied to produce W-alloy thin film composition spread materials libraries with well-defined, continuous composition gradients (film thicknesses between 1 and 2.5 µm). Three systems were studied: W-Fe (0-7 at. %), W-Ti (0-15 at. %) and W-Ir (0-12 at. %). High-throughput characterization of the materials libraries comprised of chemical, morphological and microstructural analyses. Scanning electron microscope investigations revealed that the films have a columnar structure of inverted cone-like units separated by voided boundaries, with a strong correlation to the alloying element content. Significant morphological changes occurred with an increase in the amount of the added element; W films with lower at. % of the alloying element had higher density and tighter grain boundaries, altering towards an increased amount of voids as the concentration of the alloying element increased. Electron backscatter diffraction scanning was used to determine microstructural components (grain size, grain shape, texture evolution), in dependence on the concentration of the alloying element.

Keywords: Binary tungsten alloys, thin films, magnetron co-sputtering, morphological characterization, EBSD analyses.