ELECTRODEPOSITION OF MO/MOO$_X$ THIN FILM ON NICKEL SUBSTRATE FROM DIMETHYL SULFOXIDE

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The advent of the missile, space industries and modern military technologies has spurred interest in refractory metals of the group IV, V and VI in general and molybdenum in particular, due to their high melting points, good thermal properties and excellent mechanical properties [1]. Molybdenum has been classified as a strategically sensitive material [2] and its conservation and efficient use may thus become a priority. Production methods, such as compact powder sintering and arc casting, are expensive and useful forms of molybdenum metal are difficult to fabricate. Electrodeposition of molybdenum from molten salts is of considerable industrial interest for the following reasons: (i) molybdenum cannot be electrodeposited from aqueous solution; (ii) since molybdenum is generally scarce and expensive, it is more desirable to use them as a thin coating on the appropriate substrate rather as a bulk [3-5].

In this work studied that non-stoichiometric mixed-valent molybdenum oxide (MoO_x) films were deposited on nickel substrates by electrodeposition from dimethyl-sulfoxide (DMSO) solution. Different experimental electrodeposition parameters (i.e., supporting electrolyte concentration and small amounts of water to the electrolytic bath) have been assessed in order to analyze their influence on the mechanism of induced Mo/MoO_x deposition. Cyclic voltammetry was used to assess the electrochemistry of the process while morphological changes of the deposited films were monitored by scanning electron microscopy (SEM). SEM images of the molybdenum oxide film show that the characteristic snowed structure on the film surface become more prevalent during the transition from the oxidized state to the reduced state without signification change in the Root Mean Square (RMS) surface roughness value. Furthermore, energy dispersive (X-ray) spectroscopy (EDS) studies show that the presence of water in the electrolytic bath has great effect on the morphology of the films, and the films undergo a RMS surface process with increasing water concentration in the solutions.

References

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