PREPARATION AND CHARACTERIZATION OF MOLYBDENUM OXIDE AND NEODYMIUM THIN FILMS GROWN BY SPRAY PYROLYSIS TECHNIQUE

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Abstract

Molybdenum oxides are of great technological interest because of their optical properties among which stands out the capability to switch between two optical states [1]. Additionally, they present electric properties that make them suitable cathodes in micro batteries, due to the insertion and extraction of alkaline ions in their structures [2]. Molybdenum oxide thin films are being used as gas detectors thank to their electric response [3]. On the other hand, rare earth molybdates present important physical-chemical properties such as catalytic and thermal activities. The study of the latter property has allowed establishing that molybdates present a negative thermal expansion coefficient.

Molybdenum oxide thin films doped with neodymium (MoO3:Nd) have been grown in this work, using the spray pyrolysis technique from tetra-hydrated ammonium molybdate ((NH4)6Mo7O24.4H2O ) and neodymium nitrate. The procedure consisted of spraying ammonium molybdate and neodymium nitrate aqueous dissolutions on glass substrates heated up to temperatures between 523 and 673K. Air at 2.02 x10^5 Pa was used as carrier. Layer thickness was varied by spraying dissolution volumes between 5.0 and 30.0 ml. Neodymium nitrate was prepared by adding nitric acid dissolution onto neodymium oxide Nd2O3 (Aldrich). The concentration of cations Mo6+ y Nd3+ in the sprayed dissolution was 0.1 M.

The obtained film’s crystallography was characterized through X-Ray Diffraction (XRD) and their morphology through scanning electron microscopy (SEM). XRD preliminary results show that, for all sprayed volumes, non stoichiometric oxygen deficient phases were grown, for instance: Mo9O26 (PDF120753) and Mo18O52 (PDF74164). SEM results show the films’ morphology as highly rugged with coral-like surface structure and grain sizes between 5 and 40 nm.

Reference: