A study of thin films of V_2O_5 containing molybdenum from an evaporation boat

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Abstract

An attempt was made to produce thin films of vanadium oxide by evaporating V_2O_5 in vacuum using molybdenum boats. Following analysis of the films by X-ray photoelectron spectroscopy and Rutherford backscattering spectrometry, it was found that the films contained a large amount of molybdenum (atomic ratio of Mo:V > 1). Films were chemically inhomogeneous along the direction of growth such that the value of the atomic ratio decreased from the substrate side of the film to its interface with the air. However, a study of the optical properties of the films revealed that they were optically homogeneous. The films went through a semiconductor-to-metal phase transition at a temperature of approximately 200 °C. When annealed in vacuum at a temperature of 275 °C, it was found that, (a) the films remained amorphous, (b) there was a loss of oxygen leading to an increase in their electrical conductivity, (c) their thickness decreased leading to a larger refractive index of the films, and (d) their band gap energy shifted to a higher photon energy by approximately 0.1 eV.

Keywords: Evaporation; Impurities; Molybdenum oxide; Vanadium oxide