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Investigation of stoichiometry effect on structural and electro-optical properties of vanadium oxide thin films deposited by HiPIMS

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Abstract

In this study, vanadium oxide thin films were deposited on glass substrates by high-power pulsed magnetron sputtering (HiPIMS) at reactive gas ratios of oxygen to argon of 1, 2.5, 5, 10, 15, 20, 25, and 30% in a 45 μ s pulse at an initial deposition chamber pressure of 2×10^{-7} Torr and a working pressure of 5 mTorr, and were subjected to structural and electro-optical studies. The chemical composition of these metal oxides was determined by X-ray photoelectron spectroscopy (XPS) analysis and they were characterized as VO_x with varying x-values. By examining the electro-optical properties, the transparency and optical transmittance of the films, as well as their electrochromic properties, were determined by cyclic voltammetry analysis. It was found that oxygen deficiency in longer pulses causes a decrease in the average optical transmittance and also a decrease in the optical band gap of the films.

Keywords: High power pulse magnetron sputtering; Thin film; Vanadium oxide; Electrochromic

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