

## Sol-gel growth and structural, electrical, and optical properties of vanadium-based oxide thin film

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Thin films of  $V_2O_3$ ,  $VO_2$ , and  $V_2O_5$  have been prepared from single precursor solution by varying post-annealing condition. When annealed in air,  $V_2O_5$  films with orthorhombic structure were obtained while rhombohedral  $V_2O_3$  films were produced when annealed in vacuum. Monoclinic  $VO_2$  films were obtained when  $O_2$  gas was supplied during the vacuum annealing. Electrical and optical data indicated that the  $V_2O_5$  and  $VO_2$  films are semiconducting while the  $V_2O_3$  films are metallic at room temperature. Chromium doping in  $VO_2$  resulted in a decrease of the resistivity with a change of the conduction type from  $n$  to  $p$ . As the shown in Fig. 1, a phase transformation from monoclinic to orthorhombic structure was also observed for the Cr-doped  $VO_2$ . The observed optical absorption structures of the films were interpreted in terms of transitions involving O  $2p$  and V  $3d$  bands. The crystal-field splitting between  $t_{2g}$  and  $e_g$  states of V ion is estimated to be about 1.5 and 1 eV for  $V_2O_5$  and  $VO_2$ , respectively.

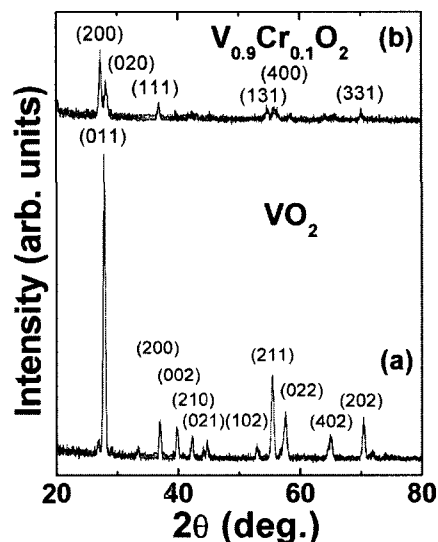


Fig. 1. Comparison of XRD spectra of pure  $VO_2$  film with monoclinic structure (a) and  $V_{1-x}Cr_xO_2$  ( $x = 0.1$ ) with orthorhombic structure (b).