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Phase Transitions in Electron Beam Deposited Cr-doped VO_2 Thin Films[1] DOMINIC ROTA, Belmont University, KENT HALLMAN, Vanderbilt University, DAVON FERRARA, Belmont University, RICHARD HAGLUND, Vanderbilt University — Three phases of the semiconducting state of VO_2 are known, denoted M_1, M_2 and T; the M_2 phase in particular has alternating vanadium chains arranged in antiferromagnetic pairs. This suggests potentially interesting magnetic and optical properties, motivating our interest in developing a robust protocol for preparing thin films of the M_2 and T phases for studies of the optically induced semiconductor-to-metal transition (SMT). A protocol for electron beam deposition of Cr-doped VO_2 ($Cr_xV_{1-x}O_2$) thin films was developed, allowing for low-cost and efficient fabrication of homogenous films, beginning with powder precursors for vanadia and chromia in appropriate proportions. The films were characterized by resistivity and reflectivity measurements of the SMT with concentrations of Cr dopant ranging from x=0 to x=0.04. Raman spectroscopy was used to identify the structural phase transitions and revealed that the structural phases M_1, T, and M_2 can be determined by comparing differences in the spectrum. Comparing the resistivity hysteresis curves to the Raman spectroscopic measurements, we find that single-phase structures occur for x=0 (M_1) and x=0.04 (M_2) while concentrations between the x=0 and x=0.04 exhibit a mixture of at least two structural phases, including the T phase.

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