GROWTH AND CHARACTERIZATION OF N-DOPED VO2 THIN FILMS ON QUARTZ SUBSTRATES BY THE MIST CVD

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Vanadium dioxide (VO2) exhibits metal-insulator transition (MIT) at 67°C [1]. This transition results in a considerable change in the resistance and transmittance in the infrared region. Recent efforts have been studied to utilize this change in infrared transmittance for smart windows. However, because the MIT occurs at a high temperature of 67°C, it is crucial to lower it to near outdoor temperature for smart windows. Therefore, attempts have been made to decrease the transition temperature using elemental doping or strain engineering [2,3]. In this study, nitrogen (N) was utilized as a dopant and N-doped VO2 thin films were deposited by the mist CVD, which has been reported for N-doping [4].

First, N-doped VO2 thin films were deposited on a quartz substrate with SnO2 buffer layers, possessing a relatively small lattice mismatch with VO2. X-ray diffraction analysis revealed that polycrystalline VO2 thin films were deposited on SnO2 buffer layers in both undoped and N-doped samples in the temperature range from 425°C to 450°C.

Temperature-resistance and temperature-transmittance characteristics of the VO2 thin films were measured to investigate their electrical, optical properties, and MIT temperatures. As shown in the figure, undoped VO2 thin film showed a slight decrease in the MIT temperature with decreasing VO2 deposition temperature. In contrast, N-doped VO2 thin films exhibited a notable decrease in the MIT temperature from 67°C to 34.6°C, which was considerably lower than the previously reported transition temperature of approximately 50°C for N-doped VO2 thin films [2]. Detailed results will be presented in the presentation.