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Thermal oxidation of VN as an alternative method to produce thermochromic VO2 films

David PILLOUD[1], Jean-Baptiste SAUTET[1], Fabien CAPON[1], Aurélien DIDELOT[1], David MERCS[2], Patrice MISKA[1], Jean-François PIERSON[1]

[1]IJL, Université de Lorraine, NANCY, France [2]Viessmann Faulquemont SAS, FAULQUEMONT, France

david.pilloud@univ-lorraine.fr

Due to its reversible semiconductor-to-metal transition at 68 °C, VO_2 is an extensively studied material. In thin film form, it is suitable for various technological applications such as smart windows, bolometers, sensing devices… However, elaboration of VO_2 filmsrequires a stringent control of the stoichiometry due to the numerous phases belonging to the V-O system. Up-to-date, amongst the various methods to deposit VO_2 films, reactive sputtering is mainly used. However, obtaining thermochromic VO_2 thin films by an inexpensive and simple method, convenient for an industrial process, still remain a challenging task. For this purpose, a new approach, called “sputtering-oxidation-coupling method” (SOC) has been recently developed by Xu et al. [1]. This 2-steps method is based on the sputter deposition of vanadium metallic thin films, followed by a quick air-oxidation in the range 723-763 K. Providing an accurate control of the oxidation time, well crystallized VO_2 films with good resistivity switches were obtained.This presentation aims to investigate the above-mentioned SOC method by oxidizing vanadium nitride films comparatively to vanadium films. Indeed, VN films are claimed to follow another oxidation process than V, though their oxidation onset are very close [2]. In our work, VN and V thin films were sputter deposited on various substrates (silica, silicon, aluminium foils) and annealed in air during 30-180 seconds. Oxidized films were analyzed by X-ray diffraction (XRD), scanning electron microscopy (SEM), spectroscopies (Raman, UV-vis and FTIR), 4-point probe and IR-thermography. Our results showed that the SOC method applied to VN films is suitable to form thermochromic VO_2 with good optical and electrical transitions.

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