Characterization of copper vanadates: a promising candidate for photoactive thin films deposited by physical methods

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The urge for nonfossil fuels makes photoeletrochemically produced hydrogen a very versatile and renewable energy source [1]. The main challenges in this process is to find suitable semicondutors, with intrinsic properties such as: favourable bandgap for harvesting of as much of the visible light spectrum as possible [2], straddling of water's oxidation and reduction potentials by the energy levels of photogenerated electrons and holes [3], and stability within the electrolyte [4]. In this regard, copper vanadates ($Cu_{(1-x)}V_xO_y$) emerge as promising candidates, with low bandgap (~ 2 eV) [5] and good stability in alkaline environments [6]. This work presents an alternative for the production of CuV_2O_6 thin films through solid state reaction. CuV_2O_6 was produced by stoichometric mixing of CuO and V_2O_5 powders followed by calcination of the resulting material at 620 °C for 12 h. The copper vanadate powder was pressed into pellets and sintered at 650 °C for 48 h. XRD analysis confirms it as a highly pure material, with triclinic C-1 structure with a configuration of layers of CuO_6 and VO_6 octahedra, in agreement with PDF#74-2117. Scanning electron microscopy shows anisotropic, rod-like morphology. Therefore, we were able to obtain a pure phase, suitable for using as a target in physical deposition methods. The obtention of copper vanadate thin films in a transparent conducting glass substrate will be achieved through Pulsed Laser Deposition and Pulsed Electron Deposition. Future measurements of photocurrent under solar illumination simulations and electrical properties aim to compare these two deposition processes, and other characterization analysis will be able to enhance a fundamental study on such properties and correlate them with the structural features.

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