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Optical and electrical properties changes induced by cation size in rare-earth vanadates REVO3 (RE : La, Pr, Nd and Sm)

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Conventional solar cells have limited energy conversion efficiencies because photons with energy lower than the band gap are not absorbed by the system and those with higher energies are inducing phonons. A possible way to improve the efficiency of solar cells consists in using multi-junctions with several layers, covering the largest range of the solar spectrum. In this way Mott Insulators have been proposed as solar-absorbers because their property of carrier multiplication could be efficient [1]. $LaVO_3$ is among those which could be interesting, with an indirect forbidden band gap of 1.1 eV and a good absorption coefficient [2] which seems optimal according to the Shockley-Queisser limit [3]. In the same view other rare-earth vanadates ($REVO_3$, where RE: Pr, Nd or Sm) could be interesting.
Usually crystallized rare-earth vanadates films are deposited by ALD, MBE or obtained with powder reactions. After studying the conditions of co-sputtering for each system (metallic and poisoned regimes) we propose a two-step method to obtain REVO3 thin films. Thin films of REVO are first sputtered and both RE/V atomic ratio and film thickness are evaluated by a Scanning Electron Microscope (SEM). Then to get crystallized $REVO_3$ we use an external annealing in a reducing atmosphere composed of a mix of Ar and H_2.
Films are analyzed by the use of X-Ray diffraction (XRD), X-ray Photoelectron Spectrometry (XPS), Fourier Transform InfraRed spectroscopy (FTIR) and finally resistivity measurements to know what the cation size effect on the obtained properties is.

Keywords
solar perovskite
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