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Lanthanum cobaltite LaCoO₃ layer for thermal solar collector

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LaCoO₃ shows a metal-insulator transition associated to an interesting change in optical properties. Deposited on aluminum and silicon substrates, the material acts as a smart selective layer due to the variation of emissivity ($\Delta\epsilon$). LaCoO₃ was synthesized by magnetron sputtering in order to make an easy upscaling and the temperature of metal-insulator transition (TMI) was lowered using nitrogen-doping in order to use it as a thermal-control coating on solar panels. A two-steps process was employed: the first step is the co-sputtering of cobalt and lanthanum in poisoned regime followed by a crystallization step in a furnace. Samples are characterized with a scanning electron microscope, X-ray diffraction, secondary ion mass spectroscopy. The optical properties of the samples have been studied, using an infrared or UV-visible reflectance versus temperature to investigate their ability to regulate temperature. Transmission electron microscopy analysis shows a globular micro-structure. Crystallization's kinetic has been studied by observing the evolution of (110) planes. Reflectivity versus temperature gives a variation of emissivity ($\Delta\epsilon$) over 50% at $\lambda=8\mu\text{m}$ between 573K to 773K.

Keywords

Perovskite

Oxynitride

Magnron Sputtering

thermochromic

thin film