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PLD growth of strontium titanate thin films on silicon substrate for photoelectrochemical water-splitting

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Abstract

Epitaxial films of metal oxides deposited on silicon substrates represent a new type of material that could be used as protective (or electroactive) layer in the photoelectrochemical water splitting. To understand the influence of crystalline and interfacial properties of oxide layer on the water splitting process a ~10 nm strontium titanate (STO) films have been grown using the PLD method on bare and reduced graphene oxide (rGO) buffered silicon substrate. Our approach relied on the oxide-silicon integration using combination of SrO-assisted deoxidation and controllable coverage of silicon surface with a mono- to three-layer of spin-coated GO. The STO films have been grown at 515 and 700 °C and various experimental techniques were used to examine the surface and crystalline properties of grown films (reflection high energy electron diffraction, atomic force microscopy, scanning electron microscopy, X-ray diffraction, X-ray reflectivity and X-ray photoelectron spectroscopy). The results show that the best the crystallinity of the STO thin films was obtained on rGO/SrO deoxidized silicon surface at 515 °C. Future studies will be devoted to electrochemical characterization of the grown films, that will help to establish clearer link on how the interface and crystalline parameters affect the water splitting process.

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