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Quasi-1D hierarchically nanostructured F:SnO₂ transparent conductive oxideDario Neri¹, Francesco Fumagalli¹, Silvia Leonardi¹, Ludmilla Steier², Michael Graetzel², Fabio Di Fonzo¹¹CNST Istituto Italiano di Tecnologia, Milan, Italy ²ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE EPFL, Lausanne, Switzerland

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SnO₂-based Transparent Conductive Oxides (TCOs) are currently widely used in different applications, e.g. as electrodes for photovoltaic, water splitting and fuel cells, for their high performances in terms of carrier density and mobility, low costs, non-toxicity and high transparency in the visible spectrum. To maximize the performances a proper balance between surface-to-volume ratio and crystallinity grade is required, in order to enhance the active surface and improve the carriers transport. Despite some SnO₂-based TCO porous films have been already realized, hierarchical nanostructured contacts have not been done yet. In this work Pulsed Laser Deposition technique has been exploited for this purpose. The resulting tree-like nanostructured film can be tuned in a wide range of porosity, maintaining excellent electrical properties. Electrodes performances have been analyzed from electrical, electrochemical and optical points of view. A gold contact evaporated on the top of the films has been used to determine the conductive performances. With Electrochemical Impedance Spectroscopy we monitored their behavior in electrochemical cells. UV-vis measurements have proved that the optical path can be engineered altering the porosity of the film. These films are suitable for subsequent doping or functionalization. In the present work a novel thermal doping process with Fluorine precursor has been performed as an efficient and facile technique to produce hierarchical nanostructured FTO films.

Keywords

FTO

Nanostructured

PLD

Pulsed Laser Deposition

Thermal Doping