Fibre Laser Processing for Fabrication of Perovskite and Dye-Sensitized Solar Cells

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Perovskite solar cells (PSCs) and Dye-Sensitized Solar Cells (DSSCs) are promising new-generation photovoltaic applications. One of the commonly-used components for the architecture of PSCs and DSSCs is the metal oxide thin films such as compact or mesoporous TiO_2 layers on the transparent conducting oxide (TCO) coated substrates. Currently, conventional fabrication of these layers requires high-temperature heating processes that are considerably time-consuming and also make it difficult to fabricate integrated or multifunctional devices on the same substrate. Laser processing offers an opportunity to develop a rapid, localized and precise treatment without damaging the substrates or surrounding materials. Researchers at The University of Manchester have developed a rapid and non-contact one-step fiber laser process to generate both mesoporous and compact TiO_2 films on tin-doped indium oxide (ITO) glass [1, 2]. The average power conversion efficiency (PCE) obtained for the PSCs and DSSCs by laser irradiation for 1 min, prepared under a high relative humidity of around 60%, is equivalent or higher than those by furnace treatment for 2 h [1, 2]. The use of the laser process offers an economically feasible, industrially viable solution to the challenge of rapid fabrication of mesoscopic PSCs and DSSCs and integration of multifunctional devices, and opens up a potential route to manufacture tandem, patterned or aesthetic solar cells in the future.

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[2] A. Hadi, Q. Chen, M. Curioni, R. Xiao, T. Huang and Z. Liu. One-Step Fiber Laser Fabrication of Mesoporous and Compact TiO_2 Layers for Enhanced Performance of Dye-Sensitized Solar Cells. ACS Sustain. Chem. Eng. 2018, 6 (9), 12299–12308