2nd Edition of Global Summit on

Renewable Energy & Emerging Technologies

October 05-06, 2018
Barcelona, Spain

Cecile Charbonneau, Trends in Green chem 2018, Volume 4
DOI: 10.21767/2471-9889-C3-014

SOLUTIONS FOR LARGE SCALE AND LOW-COST MANUFACTURING OF ELECTRON COLLECTION SEMICONDUCTOR LAYERS IN LEAD HALIDE PEROVSKITE SOLAR CELLS

Cecile Charbonneau
Swansea University, UK

Lead halide perovskite solar cells have been the focus of interest of scientists in 3rd generation solar energy sector for just over 5 years. Yet, certified energy conversion efficiency rate up to 22.7% (KRICT, Korea Research Institute of Chemical Technology) and stability records over 1000 hours (NREL, US Department of Energy's National Renewable Energy Laboratory) have already been reported for small photovoltaic (PV) cells. This places emerging perovskite lead halide technology at the forefront of future PV technology. Large scale manufacturing of modules is underway but still faces a number of challenges owing to the very small thickness of the active layers and materials low tolerance for processing conditions. In this work, we address some of the issues related to the fabrication of thin electron collection TiO_2 compact and mesoporous layers. Colloids containing small nanoparticles of anatase TiO_2 (aqueous synthesis at 80°C, P_{atm}, 30 mins) are used as precursors for the UV-Vis processing of compact and porous TiO_2 semiconductor layers, at temperatures compatible with the use of flexible metal or plastic substrates. The role of additive oxalic acid on the formation and properties of these films is investigated. Finally, these colloids are used as media for ink-jet printing of patterned TiO_2 semiconductor layers, a feature currently required for optimizing the efficiency of glass-based lead-halide perovskite modules.

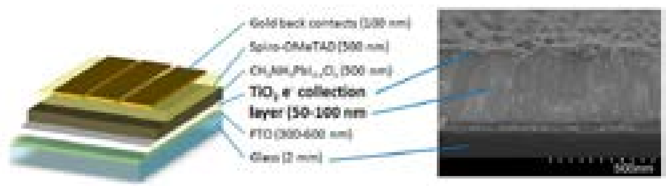

Figure 1. Schematic of a planar lead-halide perovskite device and electron microscope image of a glass-FTO-TiO2 compact in cross section.

Recent Publications

1. Charbonneau C, Holliman P, Watson T, Worsley D (2015) Facile, self-assembly of metal oxide nanoparticles. Journal of Colloid and Interface Science 15(442):110-119.
2. Cecile Charbonneau, Petra J Cameron, Adam Pockett, Anthony Lewis, Joel Troughton, Eifion Jewell, David Worsley and Trystan Watson (2016) Solution processing of TiO2 compact layers for 3rd generation photovoltaics. Ceramics International 42(10):11989–11997.
3. Cecile Charbonneau, Theo Tanner, Matthew L Davies, Trystan M Watson and David A Worsley (2016) Effect of TiO_2 photoanode porosity on dye diffusion kinetics and performance of standard dye-sensitized solar cells. Journal of Nanomaterials DOI: 10.1155/2016/9324858.
4. Troughton J, Carnie C, Davies M L, Charbonneau C, Jewell E H, Worsley D, Watson T (2016) Photonic flash-annealing of lead halide perovskite solar cells in 1 ms. Journal of Materials Chemistry 4(9):3471-3476.
5. Charbonneau C, Holliman P, Watson T and Worsley D (2015) Facile, self-assembly of metal oxide nanoparticles. Journal of Colloid and Interface Science 442C:110-119.

Biography

Cecile Charbonneau is working as a Senior Lecturer for Swansea University. Her international experience includes various programs, contributions and participation in different countries for diverse fields of study. Her research interests reflect in her wide range of publications in various national and international journals.

c.m.e.charbonneau@swansea.ac.uk