TiO2-photoanodes from unconventional pastes for aqueous dye-sensitized solar cells

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Within the photovoltaic field, dye-sensitized solar cells (DSSCs) have attracted much attention, due to their low cost, high transparency and possibility of diffuse light conversion, that permits their indoor application [1]. A key aspect to be considered is the stability of the devices, as well as the sustainability of materials and components. In this view, aqueous electrolytes are considered one of the possible breakthroughs toward large-scale diffusion of DSSCs, since they are non-toxic, safe and not affected by the contamination of air moisture [2]. Furthermore, the long-term stability could be increase gelifying the electrolyte solution into a solid polymeric matrix [3]. Consequently, the dye-sensitized TiO_2 photoanode should be wettable and allow the penetration in its bulk, but, at the same time, prevent the water-induced desorption of the dye molecules.

Herein, we report morphological modifications of TiO_2 photoanodes, introduced by adding various kinds of additives, both molecular and polymeric, to the commercial Dyesol TiO_2 paste, typically used for screen printing DSSC electrodes onto conductive glass. It was found out that the addition of polyethylene glycol (PEG) modified both the morphology and the thickness of photoanodes. As a result, PEG-based cells showed an increased short-circuit current density (+18%) and power conversion efficiency (48%) with respect to the pristine counterpart. For this reason, a deeper investigation and characterization of PEG-based electrode and cells were carried out.

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[3] F. Bella, S. Galliano, M. Falco, G. Viscardi, C. Barolo, M. Grätzel, and C. Gerbaldi, *Green Chem*. **19** (2017) 1043-1051.