Hybrid solar cells operating in aqueous environment

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Photovoltaic (PV) technology has evolved rapidly in the past few decades and now encompasses a large variety of materials and device structures. A key aspect to be considered in any PV technology is the operational durability under real outdoor conditions, as well as the sustainability of materials/components and the facile integration with energy storage systems.
In the last five years, dye-sensitized solar cells (DSSCs) with water-based electrolytes have been considered as one of the possible breakthroughs towards DSSCs large-scale diffusion. If opportunely developed and optimized, aqueous solar cells can be truly considered as zero-impact photovoltaic devices fabricated with non-toxic components [1-5].
We show here the possibility of jellying the electrolyte into a solid matrix to boost stability, the possible use of different redox mediators solvated by water, the formulation of TiO_2 pastes for screen-printable photoanodes operating in water, and the replacement of Pt cathodes with more sustainable alternatives.
Overall, we will show how much water-based photovoltaics represents a challenging topic in the current energy scenario, and how it will be able to provide safe, sustainable and easily processable solar cells for building-integrated photovoltaics and portable electronics.

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