Improving the Performance of the Dye Sensitized Solar Cell (DSC)

Michael Grätzel

2009 Balzan Prize for the Science of New Materials

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Michael Grätzel is a Professor at the École Polytechnique Fédérale de Lausanne (EPFL) and Head of its Laboratoire de photonique et interfaces (LPI). The Balzan research project that he proposed aimed to improve the performance of the Dye Sensitized Cell (DSC), commonly known as the Grätzel Cell, by increasing the overall efficiency of this kind of photovoltaic cell from its present 12.3 to nearly 15 percent, which would strongly contribute to making the DSC a widely used method for electricity production from sunlight.

With the second half of the 2009 Balzan Prize for the Science of New Materials, the Laboratory of Photonics and Interfaces at the École Polytechnique Fédérale de Lausanne (EPFL), directed by Michael Grätzel, acquired an Atomic Layer Deposition System for the Laboratory and hired Dr**.** Aswani Yella as a postdoctoral fellow for two years. A sum was also set aside to support visits of students and researchers from Italian universities within a framework of collaboration on the research project.

Adopting an experimental approach to the design of the Grätzel Cell, the Balzan research project focused its attention on the interface that separates the materials used in the device for transporting the negative charge carriers (electrons) and positive charge carriers (called holes). It explored several new strategies to retard the interfacial charge carrier recombination rate. The research was conducted to improve the self-assembly of the dye molecules in order to form more compact films at the surface. Grätzel's research group modified the chemical structure of the dye molecules to

endow them with long alkyl chains enhancing their lateral attraction, which was expected to increase the packing of dye molecules retarding the unwanted interfacial recombination of negative and positive charge carriers. The group also attempted to use additives in the electrolyte that would promote the formation of dense monolayers of dye molecules. Judicious engineering of the interface retarded the interfacial charge carrier recombination, increasing the open circuit voltage and cell efficiency.

The work on introducing the ALD overlayers on the surface of the mesoscopic titania films to stop interfacial charge recombination was carried out by Aravind Kumar Chandiran. Aswani Yella tested the films prepared by Dr. Chandiran to realize gains in voltage output and overall efficiency as foreseen in the proposal.

Publications

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