

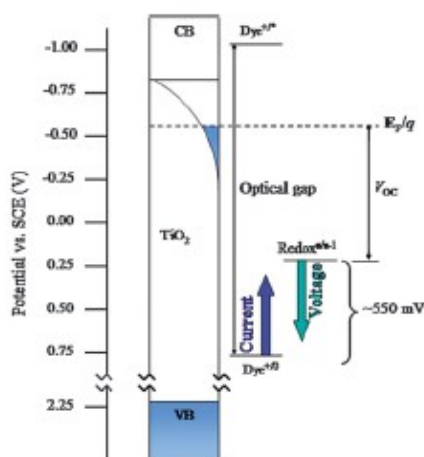
FUTURE-GENERATION DYE-SENSITIZED SOLAR CELLS

Mary Faia

Northwestern University

Evanston, IL 60208

The dye-sensitized solar cell (DSSC) has attracted much attention as a possible source of efficient and inexpensive solar energy conversion since its conception by Gratzel and O'Regan in 1991. The Gratzel cell comprised of nanoparticle TiO_2 sensitized with $[\text{Ru}(4,4'\text{-dicarboxy-2,2'\text{-bipyridine)}_2(\text{NCS})_2]$ in contact with I_3^-/I^- reached the current record maximum efficiency of 11.2% and has long since plateaued over the past 17 years, indicating that this particular system may be essentially optimized. Two strategies for improving the efficiency of DSSCs are illustrated in the figure below. One strategy is to decrease the optical bandgap, and another is to shift the redox shuttle's electrochemical potential to a more positive value. The former will allow more light collection and therefore greater photocurrent density, and the latter will increase the photovoltage.¹ The overall efficiency of a DSSC is determined by the product of the photocurrent and photovoltage, so as long as both or one of these is increased without compromising the other, significant improvements in future-generation DSSCs are anticipated.



1. T.W. Hamann, R.A. Jensen, A.B.F. Martinson, H.V. Ryswyk, J.T. Hupp, *Energy Environ. Sci.*, **2008**, 1, 66.