Nanocrystalline core / shell metal oxide films for dye sensitised solar cells.

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Dye sensitised nanocrystalline solar cells are attracting extensive interest as a low cost alternative to more conventional inorganic devices. Such devices are based upon the sensitisation of mesoporous, nanocrystalline metal oxide films with molecular dyes.

Optimisation of device performance requires careful control of the properties of the nanocrystalline metal oxide film. In this paper, we will address the conformal growth of metal oxide barrier layers on the surface of preformed nanocrystalline titania films. Barrier layers of varying thickness can be grown by a simple solution phase deposition route. These barrier layers are shown to retard interfacial charge recombination dynamics, as illustrated in the figure below, resulting in up to a 30 % improvement in the performance of dye sensitised solar cells.

Further studies will address alternative design strategies intended to optimise electron transport through the film relative to interfacial charge recombination, including in particular the use of asymmetric metal oxide nanoparticles with high geometric aspect ratios.