takes place in the TiO_2 film, which is separated from the photon absorption site (i.e. the photosensitizer); thus, effective charge separation is expected. This photon-to-current conversion mechanism in a DSSC is similar to the mechanism for photosynthesis in nature, in which chlorophyll functions as the photosensitizer and charge transport occurs in the membrane.

In conventional *p-n*-type solar cells and classical PSCs using polycrystal or single-crystal photoelectrodes, electronic contact between the components that form the photovoltaically active junction, and the equilibrium between the electronic charge carriers in them, leads to space charge formation. Photogenerated charges are separated by the electric field in the space charge layer. In DSSC, however, the individual particle size is too small to form a space charge layer. Charge separation in DSSC has been discussed relative to an electrical field at the electrolyte/semiconductor interface, although not one due to space charge in the semiconductor [27]. Small cations, such as Li^+, in the electrolyte and H^+ released from the dyes upon binding, can adsorb (or intercalate) on the semiconductor surface. A dipole is formed across the Helmholtz layer between these cations and negatively charged species (iodide ions and the dye). The electrical potential drop across the Helmholtz layer will help separate the charges and reduce recombination with the dye cations or the redox mediator. Under illumination, this potential will decrease, as the electrons injected in the semiconductor will neutralize some of the positive charge at the surface.

15.1.3.2 Photovoltaic performance

Figure 15.7 shows the external spectral response curve of the photocurrent for nanocrystalline TiO_2 solar cells sensitized by N3 and black dyes with an I^-/I_3^- redox electrolyte, where the incident photon-to-current conversion efficiency (IPCE) is represented as a

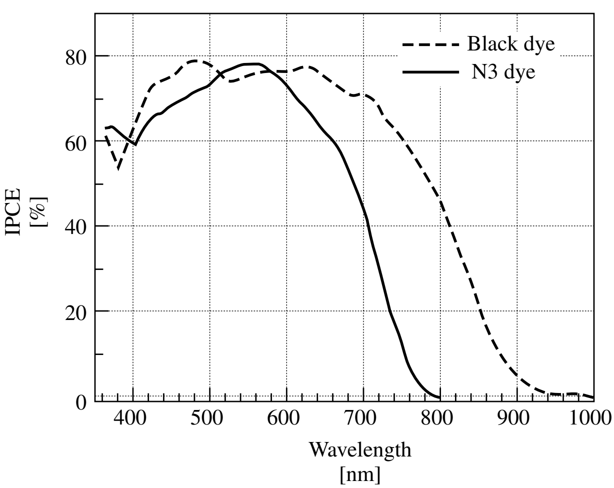

Figure 15.7 Spectral response curve of the photocurrent for the DSSC sensitized by N3 and black dyes: (——) N3 dye, (– – –) black dye. The incident photon-to-current conversion efficiency (IPCE) is plotted as a function of wavelength. The data is used from Reference [18]