involves the production of a metal film via sputtering or evaporation at low pressure. Platinum silicide, made by the sputtering of a thin platinum film onto a silicon surface, finds application in bipolar integrated circuits and in Complementary Metal Oxide Semiconductor (CMOS) structures. Amongst other topics discussed in this chapter are platinum group metal alloys for liquid metal ion sources (LMIS) and the use of platinum group metals in magnetic data storage media, thin-film magneto resistive sensors, magneto-optic media, and gas sensors. Ruthenium oxide finds wide application in thick film resistors, and palladium-silver systems are the basis of the most widely used thick film conductors as well as being valuable components in multilayer ceramic capacitors.

The use of platinum group metals is helping in the development of the new high temperature superconducting systems; they are being used in the formation of barrier layers for thin films of these materials. Platinum group metals complexes have also been incorporated into semiconductors, and into one-dimensional conductors where the columnar structures result in the compound having highly anisotropic properties.

Overall, this book reviews progress in the development of knowledge on the chemistry of the platinum group metals in the areas where there have been significant technological advances during the last ten years. There are good links throughout between scientific investigation and its commercial application, although one very important application area, that is automotive emission control catalysts, only receives brief comments, and there is no discussion of the platinum fuel cell catalyst systems which are currently receiving significant attention in both research and commercial development. The book provides a useful and stimulating reference work, particularly as it covers many different fields of scientific research in the same volume and it should therefore appeal to a wide range of research workers, particularly those interested in developing new areas of platinum metals research or commercial applications in a synergistic manner. D.T.T.

Efficient Ruthenium Dye-Sensitised Solar Cell

To-date, a large scale use of photovoltaic devices for electricity generation has not developed because the available technology is prohibitively expensive. However, a recent letter from the Swiss Federal Institute of Technology describes a photovoltaic cell system for which a commercially realistic energy conversion efficiency is claimed (B. O'Regan and M. Grätzel, *Nature*, 1991, **353**, (6346), 737). Colourless, optically transparent films of titanium dioxide, displaying the fundamental absorption edge of anatase (band gap 3.2 eV) are deposited on conducting glass sheet. These 10 μm films, which consist of particles with an average size of 15 nm and a particle surface roughness factor of 780, gave linear photocurrent response up to full sunlight.

The subsequent deposition of a monolayer of the trimeric ruthenium complex dye $RuL_2(\mu\text{-}(CN)Ru(CN)L'_2)_2$ (where L is 2,2'bipyridine-4,4'dicarboxylic acid and L' is 2,2'-bipyridine) onto the titania results in a deep brownish red coloration of the film. The high surface area of the semiconductor film and the ideal spectral characteristics of the dye lead to a high proportion of the incident solar energy flux being harvested in a cell employing this system in the photoanode; the counter electrode consisting of conducting glass coated with a few monolayers of platinum. The very fast electron injection observed with dyes such as this tri-ruthenium complex, combined with their high chemical stability, makes these compounds look attractive for practical development.

Exceptionally high efficiencies for the conversion of incident photons to electrical current are claimed, with the device harvesting 46 per cent of the incident solar energy flux. The overall light to electric energy conversion yield is 7.1 to 7.9 per cent in a simulated solar light and 12 per cent in diffuse daylight. With current densities greater than 12 mA/cm^2 and with at least five million turnovers being achieved without decomposition, practical applications may be feasible. The technology described thus seems to represent a significant advance in photovoltaic cell technology. D.T.T.