Versatile preparation method for mesoporous TiO_2 electrodes suitable for solid-state dye sensitized photocells

G K R SENADEERA*, S KOBAYASHI[†], T KITAMURA[†], Y WADA[†] and S YANAGIDA[‡]

Institute of Fundamental Studies, Hantane Road, Kandy, Sri Lanka
[†]Material and Life Science, Graduate School of Engineering, [‡]Centre for Advanced Science and Innovation, Osaka University, Suita, Osaka 565-0871, Japan

MS received 25 April 2005; revised 10 June 2005

Abstract. Nano-structured TiO_2 electrodes, suitable for dye sensitized solid-state solar cells were prepared by a new simple spraying technique (SPT). Physical properties of these electrodes were compared with the electrodes prepared by the 'doctor blade' technique (typical sliding method, DB). Dye sensitized solid-state solar cells, comprising of CuI as the hole conductor, were fabricated with these electrodes and enhanced photo responses were obtained with SPT electrodes. The effects of additives, either to the spray solution or to the hole conductor on the photoresponses of the above devices were also studied. The cells fabricated with SPT electrodes containing $Al(Bu^iO)_3$ showed ~ 2·4% efficiency and addition of 1-ethyl-3-methyl imidazolium thiocyanate into CuI layer further enhanced the efficiency up to 2·75% under the irradiance of 100 mW cm^{-2} (AM 1·5).

Keywords. Nano-oxides; dye sensitization; solid-state cells; spray pyrolysis; titanium dioxide.