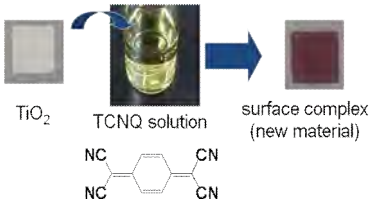
Abstract of Presentation

Novel Photovoltaics based on Direct Interfacial Charge Transfer Transition from Surface-Bound Organic Compounds to Semiconductor

Hiroshi Segawa

Research Center for Advanced Science and Technology, The University of Tokyo

Abstract :



Next-generation photovoltaics based on new concepts and/or new materials are currently attracting wide interests to create highly efficient solar energy conversion systems. Recently, we have found that some dicyanomethylene compounds (referred to as TCNX hereafter) is linked to the surface oxide anion of TiO_2 through nucleophilic addition.[1)] The interfacial complexes give a broad absorption from the visible to the near infrared region caused by a direct charge transfer transition from the HOMO of TCNX to the TiO_2 conduction band. By the use of the interfacial complexes, we constructed novel photovoltaics based on the direct interfacial electron transfer.

The solar cells were constructed with the TCNX/TiO_2 photo-electrodes, a Pt-coated counter electrode, and a liquid electrolyte (2 mol/L LiI and 0.025 mol/L I_2 in acetonitrile). Under AM1.5G-100mW/cm^2 illumination, open-circuit voltage, short-circuit current density, and fill-factor of TCNQ/TiO_2 were 0.36 V, 9.9 mA/cm^2, and 0.61, respectively. A incident photo-to-electricity conversion efficiency (IPCE) reached 80 % at 460 nm. Other TCNX/TiO_2 photo-electrodes formed with TCNE or TCNAQ were also confirmed to give the photo-to-electricity conversion in the visible to near infrared region as shown in Fig. 1. The present results give a new guiding principle for exploring next-generation photovoltaics.

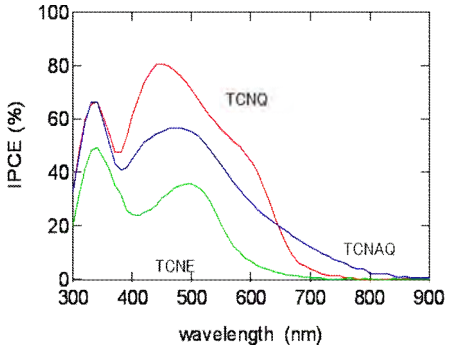
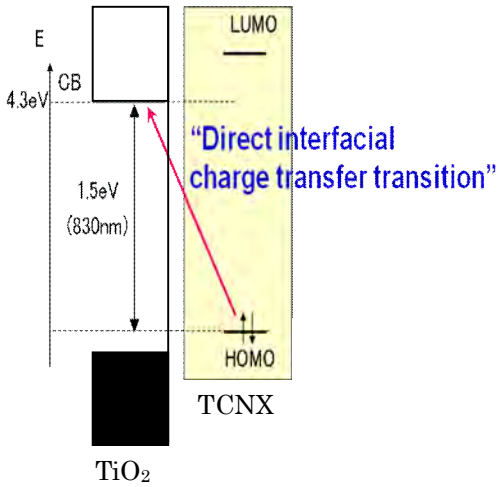


Fig 1. IPCE of TCNX/TiO_2 complex solar cells.



1. J. Fujisawa, T. Nagatani, Y. Sanehira, J. Nakazaki, S. Uchida, T. Kubo, and H. Segawa, *Chem.Soc. Jpn., 88th Annual Meeting, 3L6-05(2008).*