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Research highlights

Inorganic-Organic Hybrid Photovoltaic Devices as sustainable energy generation

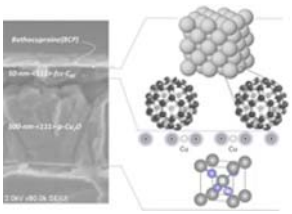

Fig.1:FE-SEM image of the cross-section of the hybrid p-Cu_2O/C_{60}/BCP photovoltaic device and schematic illustrations of Cu_2O and C_{60} structures.

Hybrid inorganic-organic photovoltaic devices are attractive as next generation high efficiency thin film solar cells, but the photovoltaic performance is still low level compared with inorganic solar cells of Si, Cu(InGa)Se_2 , and organic solar cells of C_{60}.

With this background it is necessary to investigate the fundamental aspects of these materials including the molecular configuration, energy state, and band alignment to improve photovoltaic performance.

Here, Masanobu Izaki and colleagues fabricated hybrid p-Cu_2O/C_{60} photovoltaic device on <111>-oriented Au -coated Si substrates by electro-deposition of Cu_2O layer followed by vacuum evaporation of the C_{60} layers as an acceptor layer.

The C_{60} layers exhibited face centered cubic molecular configuration on the <111>-oriented Cu_2O layer, and the preferred orientation changed from random to <111> plane depending on the preparation methods.

The electrical characteristics of hybrid photovoltaic devices varied depending on the C_{60} molecular configuration, and a rectification characteristic with an ideality factor of approximately 1 was achieved for hybrid <111>-Cu_2O/<111>-fcc- C_{60}/ bath cuproine photovoltaic devices.

This research underscores the importance not only of the configuration of both organic and inorganic semiconductors but also of the introduction of nanostructures in the light-absorbing layer and optimization of the band alignment at the heterointerface in hybrid photovoltaic devices.

Masanobu Izaki

Reference:

Authors: Masanobu Izaki, Takamasa Saito, Tatsuya Ohata, Kazufumi Murata, Binti Mohamad Fariza, Junji Sasano, Tsutomu Shinagawa, Seiji Watase.
Title of original paper: Hybrid Cu_2O diode with orientation-controlled C_{60} polycrystal.
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