

Characterizations of Electron Transport Layer in Flexible Organic Thin Films Solar Cell via Spray LBL method

慶大理工¹,[○]アリアット アタポン、白鳥世明

Keio Univ.¹,[○]Atthaporn Ariyarat¹, Seimei Shiratori¹

E-mail: shiratori@appi.keio.ac.jp

Titanium dioxide nano particle layer was fabricated by using a spray layer-by-layer (Spray-LBL) method^{[1],[2]} for organic solar cell. This process was environment friendly, low-cost, atmosphere deposition, high surface roughness and short time fabrication. In previous experiment, we succeed to fabricated TiO₂ by Spray-LBL to using for bulk heterojunction solar cell (BHT solar cell)^[3]. However, that experiment require high annealing temperature of TiO₂ layer for improving the highest efficiency of this method, which is not good for flexible devices.

In this experiment, we tried to fabricate the TiO₂ layer by Spray-LBL then fabricated the active layer of BHT solar cell and TiO₂ layer on ITO PEN and annealing the electron transport layer at low temperature (less than 150 °C). Then, we coated silver on PET for electrode contact. The schematic of this solar cell module was shown in Figure 1.

Figure 2 shows the QCM data when fabricated the TiO₂ layer by Spray LBL. We found that the thickness of thin films showed linear growth. Figure 3 shows the XPS data of oxygen region in the case of with and without annealing. After annealing, the peak of O²⁻ was changing to OH⁻ because of oxidation effect of TiO₂ layer, which means the annealing process is necessary to increase the crystal quality of TiO₂ layer BHT solar cell.

As the result, we found that this fabrication method was good for controlling the film thickness and the structure of electron transport layer was changed after annealing.

<References>

- [1] A. Izquierdo, S. S. Ono, J.-C. Voegel, P. Schaaf, and G. Decher (2005), *Langmuir*, **21**(16), pp. 7558-7567
- [2] N. Fukao, K.H. Kyung, K. Fujimoto, S. Shiratori (2011), *Macromolecules*, **44**, pp.270–72, pp. 2964–2969
- [3] A. Ariyarat, S. Shiratori (2014), *Asian Workshop on Polymer Processing 2014*, 17-20 Nov. 2014

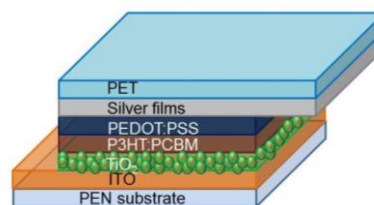


Figure 1. The schematic of this solar cell module

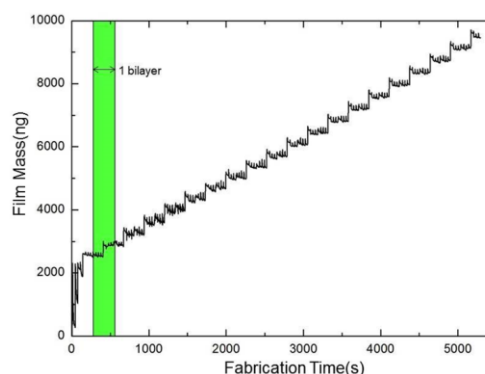


Figure 2. QCM data of TiO₂ layer when fabricated by Spray LBL

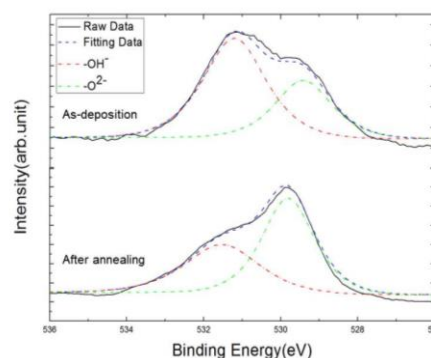


Figure 3. XPS data of TiO₂ layer when fabricated with Spray-LBL in case of with and without annealing