Local Characterization of Opto-electronic and Reverse Opto-electronic Conversion Efficiencies of Organic Solar Cells by STM

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The organic Solar Cell (OSC) are expected to be light-weighted, flexible, design friendly and cost efficient. Thus, it gathers attention in the development of sustainable energy sources. To maximize the active region for photoelectric conversion, a number of OSC have complex bulk hetero junction (BHJ) structures, where the interface between *p*-type and *n*-type semiconductor regions is heavily corrugated during the self-organizing phase separation. In an OSC device, the organic film with BHJ structure is sandwiched by a metal electrode and a transparent electrode. Thus, such nanoscale variations are not observable by an external measurement. To understand the nanoscale variation, however, is crucial for further improvement of conversion efficiency of OSC devices.

To have investigated such nanoscale variation of efficiency in OSC, we applied “scanning tunneling microscopy light emission spectroscopy” (STM-LES) and “ light modulated scanning tunneling spectroscopy’’ (LM-STS) on a naked OSC thin film without the metal electrode in the past. In this study, we measured OSC by these two methods almost at the same time. So we established the use of technique and applied to BHJ OSC cell made of poly(3-hexylthiophene)(P3HT) and1-(3-methoxycarbonyl) propyl-1-phenyl[6,6]C61 (PCBM) solar cell. At the presentation, we discuss the physical origin of the distribution in terms of the inhomogeneous sample structure and composition.