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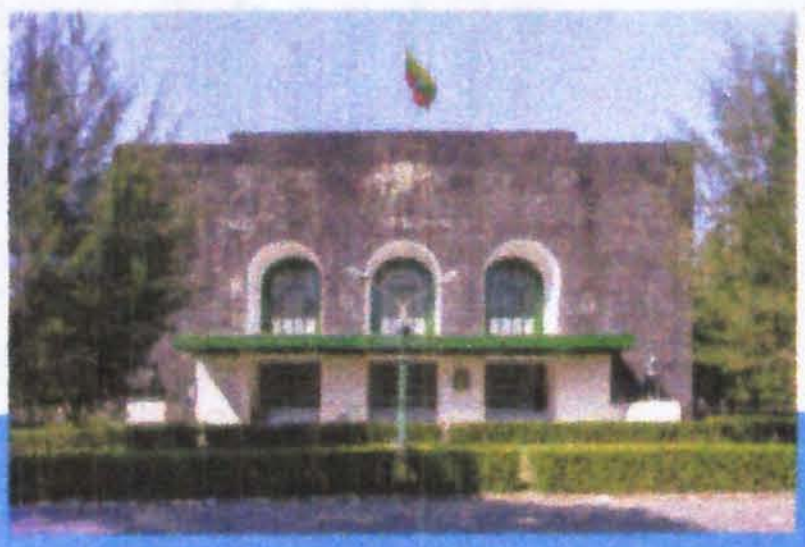
Yangon, Myanmar



PROGRAMME & ABSTRACT BOOK

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The Fabrication and Characterization of Organic-Inorganic Lead Iodide Perovskite Solar Cell

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ABSTRACT

Perovskite solar cell (PSC) based on methylammonium lead iodide possess a combination of remarkable optoelectronic properties such as high absorption coefficients, long charge carrier diffusion lengths and lifetimes. Inorganic-organic (I/O) hybrid systems based on inorganic nanoparticles and perovskite materials as light harvesters with organic hole-conducting materials have shown great potential for efficient solar cells due to the combination of superior optical properties and solution-based processes. Perovskite solar cell devices have been fabricated from inexpensive materials by a simple solution processes without the need for high-temperature annealing and considerably reduce cost.

In this work, perovskite solar cell is fabricated TiO_2 mesoporous films on ITO substrate by using sputtering method as electron transportation layer. Light harvesting methyl ammonium lead iodide perovskite layer is deposited either on TiO_2 mesoporous films and infiltrated with the hole transporting material spiro-OMeTAD. Finally, gold contact is made by using thermal vacuum evaporator. Charge separation reactions such as electron injection into the titanium dioxide film and hole injection into the hole transporting material spiro-OMeTAD as well as the corresponding charge recombination reactions are synthesized. For thickness characterization, ellipsometer and SEM measurement are measured. The surface and grain size are snalyzed by using SEM characterization. As an optical identification, the photoluminescence (PL) measurement is measured. The I-V is measured by using solar simulator to characterize the efficiency of PSC.

The spin coating rate, annealing temperature, dipping time and concentration of solution are varied to improve the quality of perovskite layer and efficiency of perovskite solar during fabrication. The four samples are fabricated by varying spin coating rate at 3000 rpm, 3500 rpm, 4000 rpm and 4500 rpm for 30 s. Methyl ammonium lead iodide band gap can be engineered between 1.59 and 1.70 eV by changing solution composition in two-step deposition process. Tetragonal $CH_3NH_3PbI_3$ phase formation is found to be preferable at all anion compositions of dipping solution. When the concentration of the 2-propanol solution of $CH_3NH_3I_3$ decreased from 15 mg to 10 mg, the average $CH_3NH_3PbI_3$ crystal size increased from about 150 nm to about 250 nm, full surface coverage, and decreased surface roughness. Perovskite solar cell, the efficiency is very low relating to moisture sensitivity and stability.

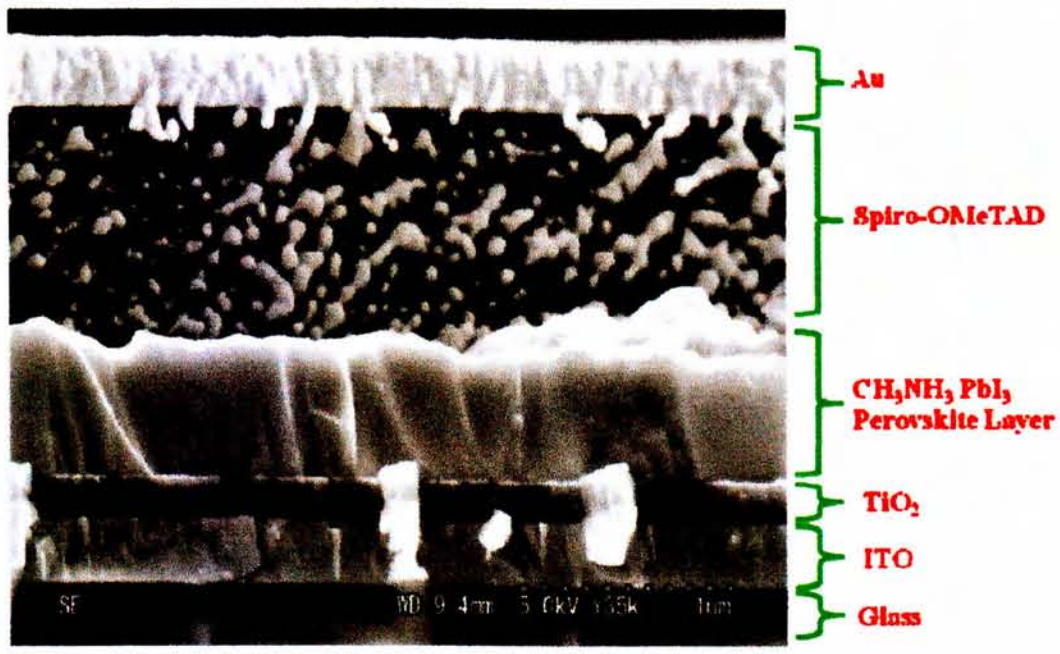

Figure 1. Cross sectional SEM Image of PSC Cell

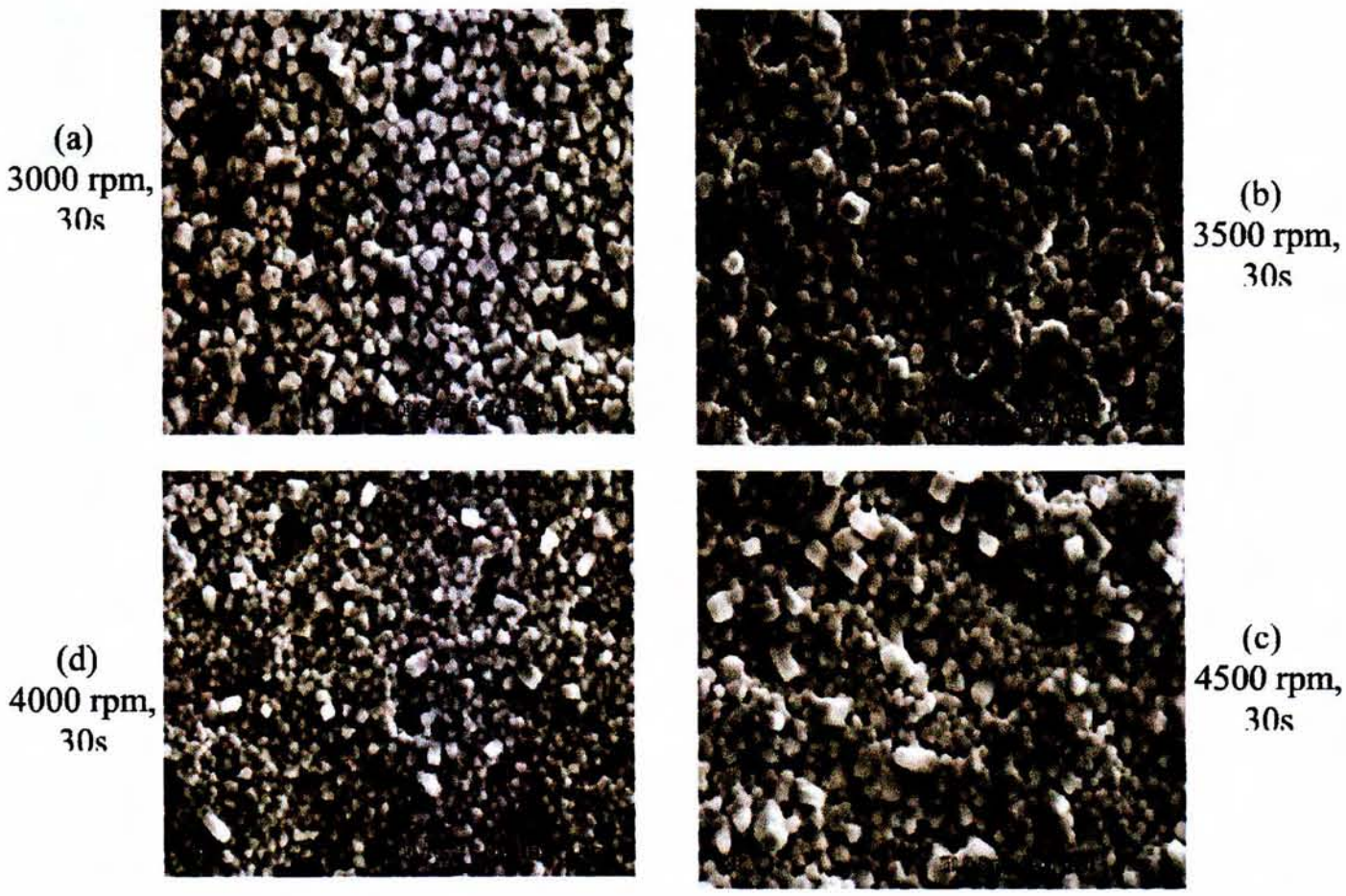

Figure 2. SEM Images of Perovskite Layers at (a) 3000 rpm, (b) 3500 rpm (c) 4000 rpm and (d) 4500 rpm for 30 s

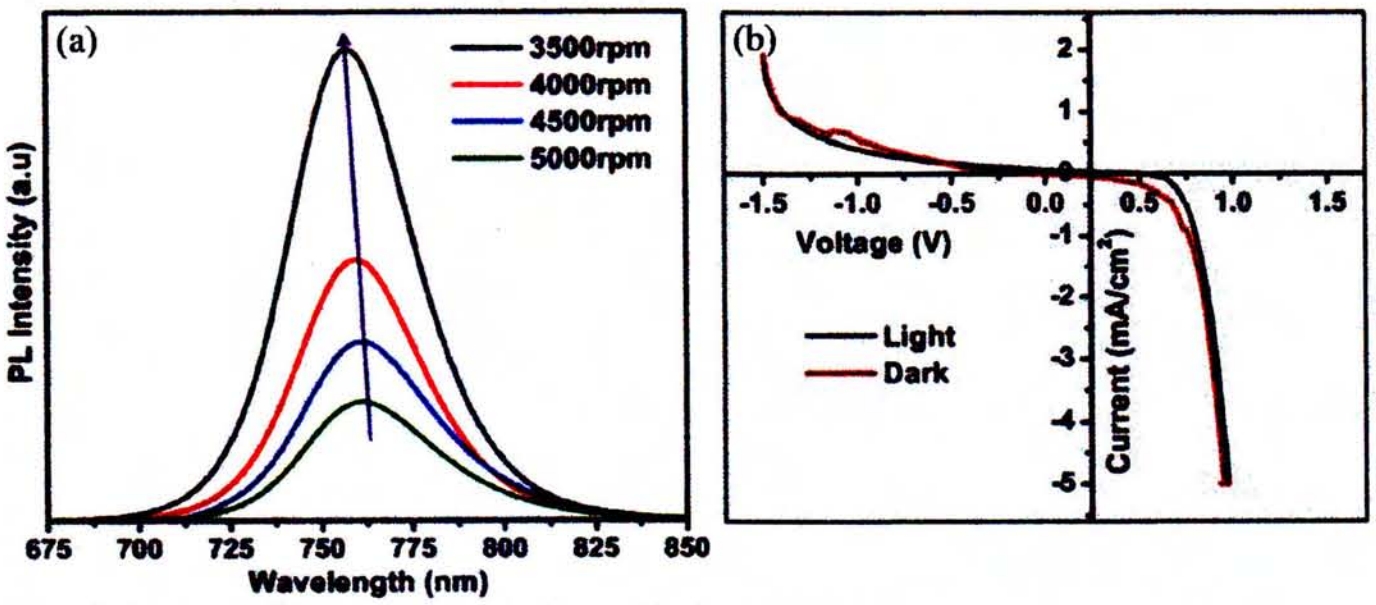

Figure 3. (a) Photoluminescence (PL) Spectra (b) Current-Voltage curve for light and dark condition

Keywords: Methyl ammonium lead iodide, SEM and Perovskite solar cell

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