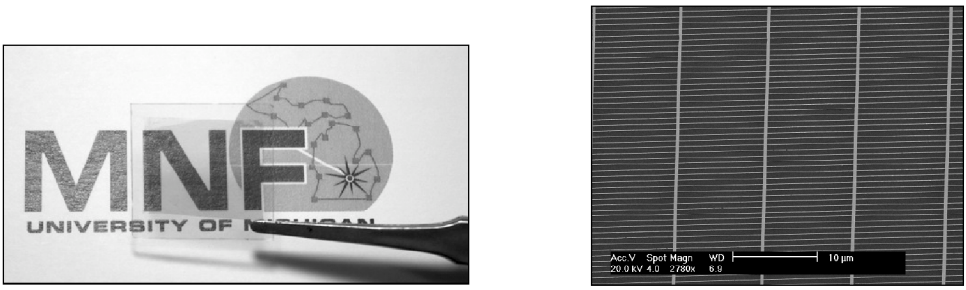
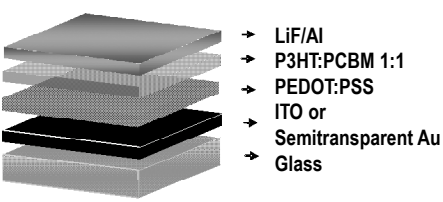
Organic Solar Cells and Light Emitting Diodes With Semitransparent Metal Electrode Replacing ITO

Myung-Gyu Kang and L. Jay Guo

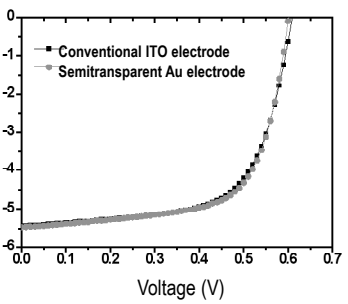


Photograph and SEM image of semitransparent metal electrode.

Organic photovoltaic cells (OPV) using renewable energy have been investigated intensively due to their potential advantages such as low cost, easy fabrication, and the compatibility with flexible substrate over large area. This project seeks to develop a new type of transparent and conductive electrode using metal to replace the Indium Tin Oxide (ITO), the most widely used material as transparent electrode for OPVs and OLEDs. Semitransparent metal electrode is in the form of nanoscale metal wire grid fabricated by nanoimprint lithography (NIL). The nanoscale grid pattern is imprinted into a polymer thin film, and then transferred into a thin metal film such as Au by metallization and lift-off. The fabricated semi-transparent metal electrode has an average transmittance of 91% in visible wavelength range, comparable to conventional high performance ITO electrode. Electrical characterization of the OPVs made with semitransparent Au electrode has shown a similar performance in power conversion efficiency to that made with conventional ITO electrode. Cu wire grid electrode was used as anode to make working OLED devices. This project is being partly supported by the National Science Foundation under grant number CMMI-0700718.



Schematic diagram of OPV.



I-V characteristic of OPV.