



Project 06: Project Progress Summary – Fall 2012 to Fall 2015

The initial proposal for this project called for the experimental demonstration of heterojunction thin-film Si solar cells showing beneficial effects of nanostructuring on electron energy band structure. Although we have not reached this very ambitious target we have made substantial progress towards it. Techniques have been developed to controllably grow “nanotrees” in the transparent conductor indium tin oxide. These “nanotrees” have been used as a basis for producing organic solar cells with improved performance, and as a template to deposit Si films in the thickness range required to produce band structure modifications beneficial for PV. The Si-coated nanotrees have shown significant light trapping ability, which is very important even in the absence of band structure modification. Heterojunctions between the conducting polymer PEDOT and silicon have been characterized experimentally and a detailed physical model developed to guide device design. New techniques and equipment for vapour-phase synthesis of conductive polymers, which will be essential to form heterojunctions on nanostructured silicon films, have been developed. Work is continuing on incorporating all these components in a complete prototype thin-film silicon solar cell.