UNIVERSITY OF SOUTH FLORIDA

Solar Photovoltaic Manufacturing Facility to Enable a Significant Manufacturing Enterprise within the State and Provide Clean Renewable Energy

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Students: Currently one Ph.D. and two MS Electrical Engineering students are being supported by the project

Description: The primary goal of this project is to enable the establishment and success of local solar photovoltaic manufacturing companies to produce clean energy products for use within the state and beyond and to generate jobs and the skilled workforce needed for them. Thin film technologies have shown record efficiencies of 20%, and present tremendous opportunities for new Florida start-up companies. USF, UCF, and UF are collaborating to develop a pilot line facility for thin film solar technologies, which will serve as a test bed for making ongoing improvements in productivity and performance of solar modules, develop advanced manufacturing protocols, and help train a skilled workforce to ensure the success of new companies.

Budget: $1.6M

Universities: USF

External Collaborators: NovaRay Solar, Bedford, MA; Brightwats, Inc., Ft. Lauderdale, FL; US Department of Energy, National Renewable Energy Lab

Progress Summary

Thin Film Pilot Line

The base upgrade build-out of the lab facility has been completed. Of greatest significance is the installation of electrical power to handle the power demands of the processing equipment. The air supply and exhaust systems were upgraded to allow installation of two large walk in hoods, and provisions for a third hood have been included in the ducting. An overhead raceway has been installed to accommodate distribution of the utility services to the processing equipment. Lab specific upgrades are still underway. These include compressed air, distilled water and chilled water supplies. The primary pace setter is the chilled water unit. It is on order and delivery is expected shortly. The plumbing and wiring for the unit have been installed. Once the unit is received it will be installed and the lab upgrade by the outside contractor will be completed. This should occur before the end of June.

The central processing unit for CIGS has been designed. Further progress in building the unit is awaiting completion of a partnership agreement with a local company. Once the agreement is signed we will work with the company to refine the design to include vacuum processing capabilities that they will contribute to the partnership. We are nearing the last stages of negotiating the partnership agreement and expect sign-off to also occur by June.

Lab Scale Experiments

In designing a large area processing unit one of the primary concerns is the efficient use of raw materials. In this regard In and Ga are a particular concern for CIGS because of potential price increases as manufacturing gets scaled up to Gigawatt levels. To address this concern we have been conducting lab scale experiments to help guide our design of the large processing unit. Another concern that we are addressing is Se utilization. While it is not nearly as expensive as In and Ga, as shown in the figure, to incorporate the needed 50 atomic per cent Se in the growing film can require Se flux levels in large multiples of the metal flux. This is not only wasteful, but also results in rapid buildup of condensed Se in the processing unit requiring frequent cleaning which will limit uptime in a production environment. The experiments that we are conducting are aimed at understanding and controlling the Se incorporation mechanism so that better management of Se can be designed into the processing unit. Similar experiments directed toward optimizing use of In and Ga are also under way.

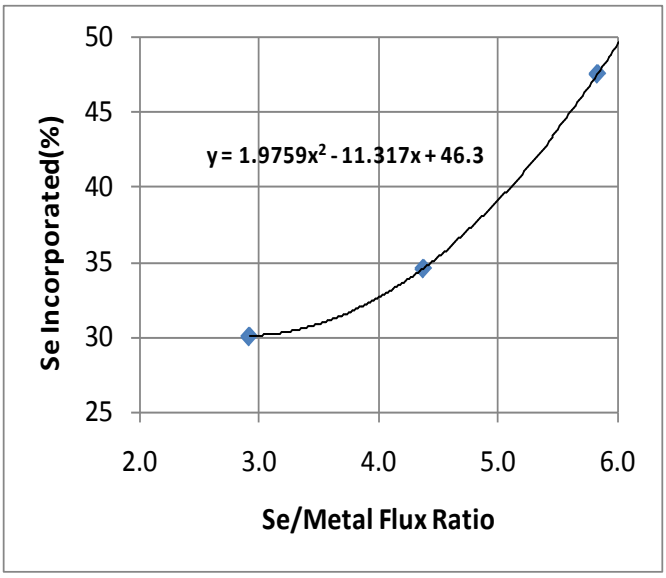

FIGURE 5. SE INCORPORATION AS A FUNCTION OF THE SE TO METAL FLUX RATIO IN A GROWING CIGS FILM.