"Making Thin Film Solar Cells based on the Earth Abundant Solar Absorber $Cu_2ZnSn(S_xSe_{1-x})_4$ from Colloidal Nanocrystal Dispersions"

171 Durham, March 3rd, 2016 at 11:00 a.m.

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The global installed capacity to generate electricity using solar cells has doubled every 2.5 years since 1975, an exponential growth similar to the famous Moore's "law" which states that the number of transistors on a computer chip doubles every 2 years. Whether the solar cell industry can maintain this Moore-like growth is an open question. One of the threats to maintaining this aggressive growth is the low abundance of some of the elements (e.g., indium and tellurium) that comprise the current thin film solar cells based on copper indium gallium selenide (CIGS) and cadmium telluride (CdTe). Copper zinc tin sulfide (Cu_2ZnSnS_4 or CZTS), copper zinc tin selenide ($Cu_2ZnSnSe_4$ or CZTSe) and their alloys ($Cu_2ZnSn(S_xSe_{1-x})_4$ or CZTSSe) are emerging as promising potential solar absorber materials for thin-film solar cells. These materials are comprised of earth abundant elements and can elevate the solar electricity production to terawatt levels without the concerns associated with the toxicity and low abundance of the elements in the current commercial thin-film solar cells. A potentially high-throughput and low-cost approach to making thin polycrystalline CZTSSe films is through annealing of coatings cast from colloidal dispersions (inks) of CZTS nanocrystals (NCs) in sulfur or selenium vapor. In this way, the NC coatings are transformed into polycrystalline films with micrometer size grains, a suitable morphology for making solar cells. The transformation of the nanocrystal coating to a polycrystalline coating is driven by the high surface area of the NCs and, consequently, the high total surface energy of the NC coating. This approach is well suited for high throughput low-cost roll-to-roll manufacturing. However, many scientific and technical challenges remain. My group and collaborators are engaged in establishing the fundamental scientific and engineering principles towards this end. In this talk I will describe our vision, achievements to date and the remaining challenges.

Refreshments will be provided in 2061 Sweeney Hall at 10:30 a.m.

If you plan to attend, ***email a question*** *to bellinda@iastate.edu and the speaker will answer your question!*

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