Eray Aydil

Professor and Ronald L. and Janet A. Christenson Chair
Chemical Engineering and Materials Science
University of Minnesota

Professor Eray S. Aydil has served as chair since 2005. He also served as the Executive Officer of that Department between 2009 and 2014. Prior to joining University of Minnesota he was a postdoctoral member of Technical Staff at Bell Labs until 1993 and a Professor of Chemical Engineering and Vice Chairman of the Department at the University of California Santa Barbara until 2005. He received his B.S. degrees in chemical engineering and in materials science, both from U. C. Berkeley in 1986. He received his Ph.D. degree in chemical engineering in 1991 from the University of Houston. His research interests range from plasma science and technology and thin films to nanomaterials and photovoltaics. A major focus is improving the efficiency of solar cells and lowering the cost of electricity production from sunlight. He has published over 200 articles and holds 7 patents. In recognition of his research, he has received the Peter Mark Award and the Plasma Prize from the American Vacuum Society (AVS), the Norman Hackerman Young Author Award of the Electrochemical Society, the National Young Investigator Award of the National Science Foundation, and the Camille-Dreyfus Teacher-Scholar Award. He is a Fellow of the American Vacuum Sociey and Editor-in-Chief of its flagship journal, the Journal of Vacuum Science and Technology. He is the recipient of a 2017 Distinguished Teaching Award for Outstanding Contributions to Graduate and Professional Education at the University of Minnesota and is a member of the Academy of Distinguished Teachers. He is a Fellow of the University of Minnesota Institute on the Environment

Making Thin film Solar Cells from Colloidal Nanocrystal Dispersions

Abstract

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 (Cu2ZnSnS4 or CZTS), copper zinc tin selenide (Cu2ZnSnSe4 or CZTSe) and their alloys (Cu2ZnSn(SxSe1-x)4 or CZTSSe) are 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.

Thursday, October 19th, 2017

2 Eaton Hall (Spahr Auditorium) | 11:00 – 11:50AM