

Direct Write Methods for Low Cost Photovoltaics

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Abstract

Solar photovoltaics are becoming an increasing part of the energy supply mix, however to have a really significant impact they must become cost competitive with more conventional energy sources. Direct write methods could help toward this significant cost reduction. We are investigating solution precursors and ink based atmospheric deposition approaches to a variety of solar cell materials. The first application we are studying is inkjet printing of contacts for photovoltaics in particular for Si solar cells. We have developed metal organic decomposition inks for silver, nickel, copper and aluminum for example. Conductivities close to that of bulk metals were obtained. The second application is the formation of the absorber layer in CuInSe_2 (CIS) based photovoltaics. CIS/CIGS is the most efficient thin film photovoltaic technology, but typically employ capital intensive PVD materials deposition and subsequent selenization steps. Our approach uses liquid based precursors that can be inkjet printed and processed under atmospheric conditions. Various precursors were identified leading to In_2Se_3 , Cu_2Se and CuInSe_2 films without a selenization

step on various substrates. Details of film deposition and processing will be discussed. The third application is in the field of organic photovoltaics. Here inkjet printing is used to deposit the photoactive layer such as a polythiophene, for example P3HT, and the conducting contact layer such as PEDOT/PSS. Details will be shown on how solvents can influence the quality of the printed material. Direct write processing of these materials may be enabling for this technology leading to an all printed photovoltaics.

Author Biography

Maikel van Hest holds a PhD in applied plasma physics from the Eindhoven University of Technology, the Netherlands. He is a scientist in the Process Development and Advanced Concepts group at the National Renewable Energy Laboratory. His research interests include liquid precursor approached to materials, especially materials with photovoltaic applications. He also is interested in exploring materials phase space by combinatorial research methods.