Active control of evaporative solution deposition by modulated infrared illumination

Jorge A. Vieyra Salas [1,2], Jørgen M. van der Veen [1], Jasper J. Michels [3] and Anton A. Darhuber [1],*

(1) Mesoscopic Transport Phenomena Group, Department of Applied Physics, Eindhoven University of Technology, P.O. Box 913, 5600MB Eindhoven, The Netherlands

(2) Dutch Polymer Institute (DPI), P.O. Box 902, 5600AX Eindhoven, The Netherlands

(3) Holst Centre/TNO, PO Box 8550, 5605 KN Eindhoven, The Netherlands

(*) Corresponding author; e-mail: a.a.darhuber@tue.nl

Presented at the 16th International Coating Science and Technology Symposium, September 9-12, 2012, Midtown Atlanta, GA[1]

We designed and built a highly adaptive and flexible system based on modulated infrared irradiation for the active control of evaporative material deposition suitable for solution processing of organic electronic materials. We performed systematic experiments using thick layers of a high-molecular-weight aqueous dispersion of PEDOT:PSS nanoparticles as well as thin

layers of light-emitting polymers in an organic solvent. We identified two complementary deposition modes, where material accumulates either in the illuminated or the non-irradiated regions, depending on the molecular weight of the solute and the solution layer thickness. We developed numerical models that account for heat transfer due to infrared illumination, solvent evaporation into the gas phase and solute redistribution in the liquid layer. The computational results agree well with the experimental observations.