Concentration Threshold for Electron Percolation in a Fullerene/Poly(phenylenevinylene) Blend

- T. Savenije, J. kroeze (Delft University of Technology), M. Wienk, and J. Kroon (ECN Solar Energy)

The transient photoconductivity of blends of a dialkoxy-phenylenevinylene polymer (PPV) and a highly soluble C60 derivative (PCBM) has been studied using the electrodeless Flash-Photolysis Time Resolved Microwave Conductivity (TRMC) technique. Thin films (*ca* 100 nm) with PCBM weight fractions, F_{PCBM}, varying from 0.20 to 0.95 were prepared by spin-coating solutions of PPV+PCBM on a quartz substrate. For photoexcitation in the range 420 nm to 700 nm, the wavelength dependence of the photoconductivity (the action spectrum) follows closely the spectral dependence of the total number of photons absorbed in the film for all blends. From this we conclude that the quantum yield for charge carrier generation, ϕ_{CS}, is independent of whether the PPV or PCBM component is photoexcited initially. Assuming ϕ_{CS} to be close to unity, the effective mobility of the charge carriers, $\Sigma\mu = [\mu(-) + \mu(+)]$, can be estimated. From F_{PCBM} = 0.2 to 0.6, $\Sigma\mu$ increases only gradually from 0.001 to 0.003 cm^2/Vs. Between F_{PCBM} = 0.6 and 0.85 however a dramatic increase in $\Sigma\mu$ occurs to ca 0.08 cm^2/Vs. This is attributed to the occurrence of extensive percolation domains of the C60 derivative within the blend which leads to a large increase in the hopping mobility of electrons.