Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Elucidating the Impact of the Full Molecular Weight Distribution on Charge Transport in Semiconducting Polymers KAICHEN GU, Dept. of Chemical and Biological Engineering, Princeton University, STEVEN XIAO, 1-Material Inc., Dorval, Quebec, Canada, JONATHAN ONORATO, CHRISTINE LUSCOMBE, Materials Science and Engineering Dept., University of Washington , YUEH-LIN LOO, Dept. of Chemical and Biological Engineering, Princeton University — Previous reports on the molecular-weight (MW) dependence of charge transport in polymeric semiconductors have focused on individual ensemble-average parameters, such as the weight- or number-average MWs or the polydispersity index. These quantities do not fully describe the molecular weight distributions (MWDs), especially when the distribution is multimodal. Field-effect mobilities have been reported to vary substantially in transistors comprising polymer semiconductors having characteristically different MWDs that are quantified by nominally the same ensemble-average properties. Starting with batches of PCDTPT and P3HT having narrow and distinct MWDs – accessed through Soxhlet fractionation and controlled polymerization, respectively – we created homopolymer blends whose MWDs are fully quantified by diffusion-ordered NMR spectroscopy (DOSY). While the mobility of transistors comprising these blends generally increases with increasing loadings of the highest-MW fraction, subtle but quantifiable differences in mobility exist and they reflect differences in the shape of the MWDs of the polymer semiconductors, which we attribute to differences in interdomain connectivity by tie-chains in the active channels.

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Date submitted: 10 Nov 2016 Electronic form version 1.4