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Three-dimensional nanomorphology in blended organic solar cells explored by photocurrent microscopy BEHRANG HAMADANI, SUYONG JUNG, PAUL HANEY, NIKOLAI ZHITENEV, National Institute of Standards and Technology, CENTER FOR NANOSCALE SCIENCE AND TECHNOLOGY COLLABORATION — The morphology of the active layer in blended bulk heterojunction solar cells strongly influences charge transport of photogenerated carriers to the contacts. Here, we present our study of nanoscale morphology and phase segregation in blended organic solar cells based on P3HT and PCBM by use of a photoconductive atomic force microscope (PCAFM). The film/air interface material blending is investigated by direct PCAFM scanning of the top film, whereas the bulk blending morphology is explored by combining the PCAFM with the use of a shallow angle microtomy technique designed at removing the film top layers by creating wedge structures along certain cutting directions. Our results show that the top layer in these photovoltaic systems is enriched with a polymer skin layer with small concentration of PCBM nanocrystals reaching the top film and creating lateral spatial segregation on the scale of 100-500 nm. In the bulk, however, much finer material blending is observed, with sub-100 nm length scales for photogenerated charge transport.

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