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Can we use scanned probe microscopy to measure local carrier mobility? SHOWKAT YAZDANIAN, SEPPE KUEHN, ROGER LORING, JOHN MAROHN, Department of Chemistry and Chemical Biology, Cornell University — A local measurement of charge carrier mobility in pi conjugate systems would provide much new insight into charge injection, trapping and transport. We have demonstrated recently that low-spring-constant cantilevers can be used to observe minute electric field fluctuations arising from thermal dielectric fluctuations in polymers [S. Kuehn et al., PRL, **96,** 156103 (2006); S. Kuehn et al., JPCB 110, 14525 (2006)]. Here we show how ultra-sensitive cantilevers can also be used to measure the local charge diffusion constant via the effect of the associated electric field fluctuations on cantilever frequency and ringdown time. Analytical scaling laws and numerical simulations of the electric field power spectrum resulting from the thermal motion of holes in a N,N'-diphenyl-N-N'-bis(3-methylphenyl)-(1,1'-biphenyl)-4,4'-diamine (TPD) / polystyrene field effect transistor suggest that the local hole diffusion constant can be inferred from measurements of cantilever frequency and ringdown time as a function of tip height and charge density. We suggest a route to directly testing the Einstein relation by comparing the locally measured charge diffusion constant to the bulk field effect transistor mobility.

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