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Direct Determination of Energy Level Alignment and Charge Transport at Metal/Alq₃ Interfaces via Ballistic-Electron-Emission Spectroscopy (BEES) J.S. JIANG, J.E. PEARSON, S.D. BADER, Argonne National Laboratory — In organic electronic devices, the difference between the electrode work function and the organic lowest unoccupied molecular orbital (LUMO) or highest occupied molecular orbital (HOMO) is a crucial parameter in determining the nature of charge transport. However, experimental determination of LUMO is challenging.¹ For the archetypal electroluminescent organic semiconductor tris-(8-hydroxyquinoline) aluminum (Alq₃), various techniques gave significantly different HOMO-LUMO gap values.² Using BEES, we directly determined the energy barrier for electron injection at clean interfaces of Alq₃ with Al and Fe to be 2.1 eV and 2.2 eV, respectively. We quantitatively modeled the sub-barrier BEES spectra with an accumulated space charge layer, and found that the transport of non-ballistic electrons is consistent with random hopping over the injection barrier. Supported by U.S. DOE Office of Science Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.


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