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Controlling organic magnetoresistance via interface engineering

C.A. RICHTER, H.-J. JANG, S.J. POOKPANRATANA, J.I. BASHAM, C.A. HACKER, O.A. KIRILLOV, Semiconductor and Dimensional Metrology Div, NIST, Gaithersburg, MD 20899, R.J. KLINE, Materials Sci and Eng Div, NIST, Gaithersburg, MD 20899, O.D. JURCHESCU, Dept of Physics, Wake Forest Univ. Winston-Salem, NC 27109, D.J. GUNDLACH, Semiconductor and Dimensional Metrology Div, NIST, Gaithersburg, MD 20899 — We present the results of experiments in which we manipulate organic magnetoresistance (OMAR) in devices based on Alq3 (tris-(8-hydroxyquinoline) aluminum) and TPD (N,N′-Bis(3-methylphenyl)-N,N′-diphenylbenzidine) by adding a self-assembled monolayer (SAM). The results of OMAR measurements on this OLED-like architecture are correlated with impedance spectroscopy results to elucidate charge carrier transport and accumulation. We observe competing OMAR mechanisms in these devices, the relative strength of which can be tuned by adding SAMs at electrode interfaces. To determine how the interfacial and structural properties of these organic devices effect the OMAR, we obtained a complete picture of the interfacial, topological, and crystalline properties of these devices by performing UPS (Ultraviolet Photoelectron Spectroscopy), XPS (X-ray PS), XRD (X-ray diffraction), and AFM (atomic force microscopy). To verify our understanding of how interfacial changes affect OMAR, we characterized simple Alq3-only devices: one with a SAM and one without it. Despite having the same current density at room temperature, the latter shows a negative MR while the former displays a positive MR.

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