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Designing interfaces for Spin Injection into Organic Molecular Solids: A Surface Science Approach

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Organic Spintronics seeks designer materials that exhibit new spin dependent transport effects [1]. However, before the search for new spintronic phenomena can take off, the challenge of spin injection has to be addressed [2]. Our group uses spin polarized scanning tunneling microscopy and spectroscopy to identify the principles governing the formation of magnetic interface states at organic semiconductor-metal interfaces that promote spin injection [3, 4]. In this talk I will discussion recent work on the "fruitfly" materials class in organic spintronics, the metal hydoxyquinolates. Within this single class, we identify metal-organic interfaces that exhibit spin polarized interface states sensitive to subtle changes in orbitals. We consider two different metal-*tris*-(8-hydroxyquinolate) compounds, Crq_3 and Alq_3, which have similar geometries but molecular orbitals with or without minor *d*-orbital mixing from the central metal cation. Surprisingly, this results in large differences in the mechanism of interfacial coupling for the two molecules. The differences give rise to interface states that are either resistive for Crq3 or metallic for Alq3, and are modeled using Density Functional Theory calculations. *This work was supported by the U.S. Department of Energy (DOE), Office of Science, Basic Energy Sciences, under Award No. DE-SC0010324* [1] Sanvito, Chem. Soc. Rev. **40**, 3336 (2011). [2] Schmidt and Molenkamp, Semicond. Sci. Technol. **17**, 310 (2002). [3] Barraud et al., Nat. Phys. **6**, 615 (2010). [4] Raman, Appl. Phys. Rev. 1, 031101 (2014).