Organic semiconductors: a blessing and a curse

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In recent years great synthetic efforts have led to the development of new conjugated semiconducting molecules and polymers. These advances in materials have in turn produced a series of solid-state organic optoelectronics devices with great performance; yet, many devices with semiconductor layers processed from solution are comprised of conventional metal or metal oxide layers that act as charge collection interlayers and/or as electrodes that are processed from vacuum. Furthermore, these materials and their interfaces are often quite sensitive to exposure to the environment. Hence, there is a real need for new and versatile methods to control the electrical properties of materials near interfaces, in particular at semiconductor/electrode interfaces.

In this talk we will discuss the importance of interfaces in several examples of organic optoelectronic devices including organic solar cells, organic field-effect transistors and photodiodes. We will show examples where the electrical properties of the electrodes in such devices can be modified by either chemisorption or physisorption. We will also present a simple processing technique for the electrical doping of organic semiconductors over a limited depth near the surface of the film that is based on immersing the film into a polyoxometalate solution. Such approached can drastically reduce the fabrication cost of such devices and simplify device architecture.