DePope - Chemistry

Abstract: One of the main display technologies used in phones, TVs and computer screens are organic light emitting diodes (OLEDs) because they are flexible, have great contrast and have high response times. However, the final step of making an OLED is placing a metal layer on top of the other device components which can cause worse efficiency and shorter device lifetime. To try and address these problems an additional layer (adlayer) is placed between the top layer of the device (known as an ETL) and the metal to act as a buffer and reduce the negative effects of the metal addition. Chemical reactions offer a unique method to create various adlayers on top of ETLs that offers potential avenues and degrees of modification, for example an addition of sulfur can reduce silver penetration into an ETL. I hypothesized a chemical reaction between TPBi, a widely used ETL, and propylene oxide would generate an adlayer that would limit the issues caused by the addition of atop metal. Reaction confirmation on the surface of the ETL was done by measuring the new adlayer signal using energy-dispersive X-ray spectroscopy (EDX) and X-ray photoelectron spectroscopy (XPS). Physical testing on the XPS showed a propylene oxide adlayer reduced metal penetrating into the ETL by 10%. This reduction of metal in the ETL increased the light emission after reaction by 10-20%.

Undergraduate Work: The overall goal is to use small organic molecules as diagnostic indicators of reaction with TPBi,to generate a better understanding of the reaction process. Previous reactions between propylene oxide and TPBi are difficult to diagnostically identify as the markers are oxygen, which is abundant in many atmospheric vapors and thus difficult to distinguish from contamination. Using molecules that contain fluorine and sulfur, elements less commonly found in air, allow me to characterize the reaction kinetics and potentially offer different avenues of modification with adlayers.