

Electronic Structure of Single Crystal α -Perylene

S. J. Pookpanratana,¹ K. P. Goetz,^{2,†} R. Ovsyannikov,³ E. Giangrisostomi,³ E. G. Bittle¹, O. D. Jurchescu,² S. W. Robey,⁴ C. A. Hacker¹

1. Engineering Physics Division, National Institute of Standards and Technology, USA
2. Department of Physics, Wake Forest University, USA
3. Institute Methods and Instrumentation for Synchrotron Radiation Research, Helmholtz-Zentrum Berlin für Materialien und Energie, Germany
4. Materials Measurement Science Division, National Institute of Standards and Technology, USA

†Present affiliation: Institute for Physical Chemistry, Universität Heidelberg, Germany

In organic electronics, the highest estimated charge mobility in a device is typically achieved when the organic semiconductor is a single crystal. However, the measurement of the electronic and chemical structure of organic single crystals by photoemission lags far behind of the thin-film counterpart. The measurement challenge is due to two reasons: the insulating nature of the crystal surface and relatively small size of the crystals (millimeter to a few hundred micrometers). X-ray and ultraviolet-based photoemission measurements are achievable on single crystal α -perylene with measurement assistance from a blue light emitting laser to enhance photoconductivity of the crystal surface. We are able to clearly resolve multiple highest molecular orbitals and determine the ionization energy of α -perylene. We are able to obtain high-resolution C 1s spectrum which we can clearly distinguish contribution from carbon atoms in the two inequivalent sites and shake-up satellite features. Electronic “band” structure measurements of α -perylene are realized using a novel angle-resolved time-of-flight electron spectrometer and the complete α -perylene electronic structure and impact on electrical performance will be discussed.

Character limit: 1231 (maximum 1300)