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Valence band structure in crystalline pentacene thin films[1]
RICHARD HATCH, DAVID HUBER, HARTMUT HÖCHST, Synchrotron Radiation Center, UW-Madison — Organic semiconductors, such as pentacene (Pn), are beginning to show promise as a low-cost substitute for conventional semiconductors for a variety of electronic devices. The overlap of π-orbitals in the Pn crystal leads to molecular orbital-derived bands. We used angle-resolved photoemission spectroscopy (ARPES) to reveal the Pn in-plane band structure of the two highest occupied molecular orbital-derived bands in crystalline thin film Pn (grown on a Bi substrate) for various temperatures between 75 K and 300 K. We mapped these two bands in several crystallographic directions with special attention given to the region near the top of the valence band and show, within the limits of our experimental resolution, that temperature does not change the dispersions of these bands. We fit the band structure to a tight binding model and compared our results with recent theoretical predictions[1-2]. We also calculated the in-plane reciprocal effective mass for the $\bar{M}$ point and compared it with the measured mobility. [1] H. Yoshida *et. al.* Phys. Rev. B **77**, 235205 (2008). [2] G. A. de Wijs *et. al.* Synth. Met. **139**, 109 (2003).

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Richard Hatch

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