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Direct observation of Frenkel and charge transfer excitons in single crystal organic semiconductor of pentacene D.-C. QI, A.T.S. WEE, A. RUSYDI, Nanocore, National Univ. of Singapore, H.B. SU, Division of Materials Science, Nanyang Technological Univ., M. BASTJAN, M. RUEBHAUSEN, Institut fur Angewandte Physik, Univ. Hamburg, O.D. JURCHESCU, T.T.M. PALSTRA, Zernike Institute for Advanced Materials, Univ. of Groningen — The understanding of lowest-lying electronic excitations in organic semiconductor solids is fundamentally important. In this paper, we report on the emerging of Frenkel and CT excitons in pentacene single crystals. We discover three novel low-energy electronic excitations below 2.0 eV using high energy resolution spectroscopic generalized ellipsometry with full polarization dependence. Surprisingly, these excitations depend strongly on polarization of the incident light, and they are discussed in terms of intramolecular Frenkel excitons and intermolecular CT excitons. In particular, the controversial description of the energetically lowest electronic excitation in pentacene crystals is explicitly clarified as a pure Frenkel exciton.

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