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Effect of pressure on electronic charge coherence in organic semiconductor single crystals

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Small molecular organic semiconductor crystals form interesting electronic systems of periodically arranged "charge reservoirs" whose mutual electronic coupling determines whether or not electronic states can be coherent over molecular distances. Recently, it turned out that band transport is realized in high-mobility organic semiconductor crystals though this situation is not common to all organic semiconductors. Series of Hall-effect measurements on different molecular crystal systems indicated that the extent of the charge coherence depends on molecular species at room temperature. In this presentation, we focus on the single-crystal molecular assembly of pentacene which does not exhibit full charge coherence at room temperature under atmospheric pressure. Hall coefficient, telling us the extent of the electronic coherence, is precisely measured for accumulated charge in pentacene single-crystal field-effect transistors at various temperatures with varied pressure. With the application of external pressure, the electronic coupling between pentacene molecules is continuously modified so that the extent of the intermolecular coherence grows with increasing pressure.