

Anisotropy of dynamic disorder and mobility in single crystal tetracene transistors.

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250 Word Abstract:

Recent interest on the topic of dynamic disorder in organic semiconductors and the influence on electrical transport has inspired several interesting experimental studies which evaluate the amount of dynamic disorder and relative device mobility in organic semiconductors. In this study, we investigate the directionality of intermolecular vibrational modes and the anisotropic mobility in tetracene single crystals to gain an understanding of the relationship between specific motions and electrical transport. We use transmission electron microscopy (TEM) and low-frequency polarized Raman to measure vibrational modes, and anisotropic mobility is evaluated using a field-effect transistor on the same crystal used for Raman study. To identify the modes measured and provide an estimate of the influence that the related motions are expected to have on the anisotropic transfer integrals, we use a combination of computational methods. We observe five low-frequency Raman-active modes in the ab plane of the crystal, and a streaking pattern is found in one direction using TEM indicative of motion in the crystal. Results relate the directionality of the mode motions and the highest and lowest mobility in the tetracene crystal.

100 Word Abstract:

This study investigates the influence of directionally oriented dynamic disorder on electrical transport in organic single crystal transistors. The intermolecular vibrational modes in tetracene single crystals are measured using transmission electron microscopy and low-frequency polarized Raman, and mobility is obtained from a field effect transistor geometry on the same crystal used for Raman study. A combination of computation methods are used to identify the modes measured and provide an estimate of the influence that the related motions are expected to have on the anisotropic transfer integrals. Results discuss the relationship between the directionality of these motions and the highest and lowest mobility in the tetracene crystal.