Crystal Structure-Mobility Correlation in TTF Based Organic Field-Effect Transistors

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Organic Field Effect Transistors (OFETs) have attracted a great deal of interest over the last few years due to their unique processing characteristics and improved electronic mobility. The fundamental material characteristics of organic semiconductors are most clearly measured in single-crystals, but very few have been studied.

Recently, we have reported that crystals of the organic material dithiophene-tetrathiafulvalene (DT-TTF) have a high field-effect charge carrier mobility of 1.4 cm^2/Vs. [1] These crystals were formed by a simple drop casting method, making this material interesting to investigate for possible applications in low cost electronics.

Here, organic single-crystal field-effect transistors (OFETs) based on materials related to DT-TTF are presented and a clear correlation between the crystal structure and the electrical characteristics is observed.[2] The observed relationship between the mobilities in the different crystal structures is strongly corroborated by calculations of both the molecular reorganization energies and the maximum intermolecular transfer integrals.[2,3]

Interestingly, the most suitable materials described here exhibit mobilities among the highest reported for OFETs, and are the highest reported for solution-processed materials. [2,4]

[1] Mas-Torrent M., Durkut M., Hadley P., Ribas X., Rovira C., *J. Am. Chem. Soc.*, 2004, **126**, 984. [2] Mas-Torrent M., et al., *J. Am. Chem. Soc.*, 2004, **126,** 8546. [3] Bromley S. T., et al., *J. Am. Chem. Soc.*, 2004, **126**, 6544. [4] Mas-Torrent M., et al., *Appl. Phys Lett.*, 2005, **86**, 012110.

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