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Bithiophenesulfonamide Building Block for Pi-Conjugated Donor-Acceptor Semi-Conductors

Melkonyan, F. S.; Zhao, W.; Drees, M.; Eastham, N. D.; Leonardi, M. J.; Butler, M. R.; Chen, Z. H.; Yu, X. G.; Chang, R. P. H.; Ratner, M. A.; Facchetti, A. F.; Marks, T. J

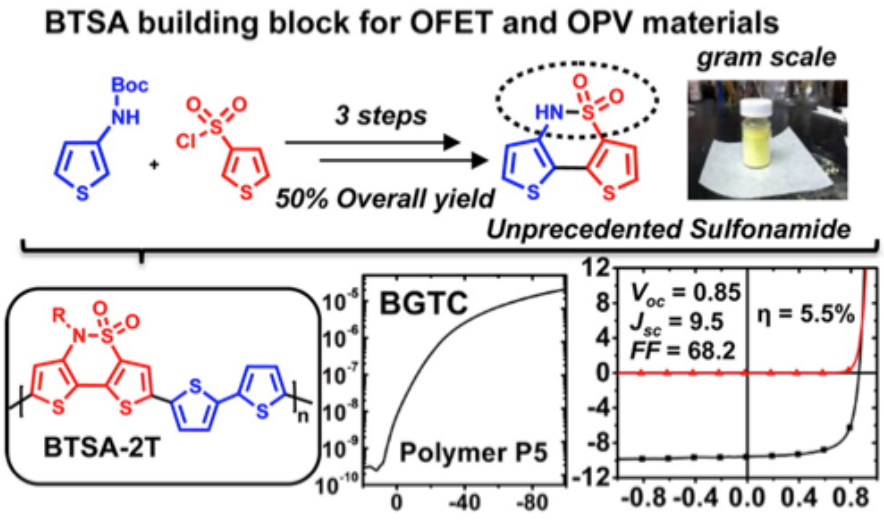

Figure 5.

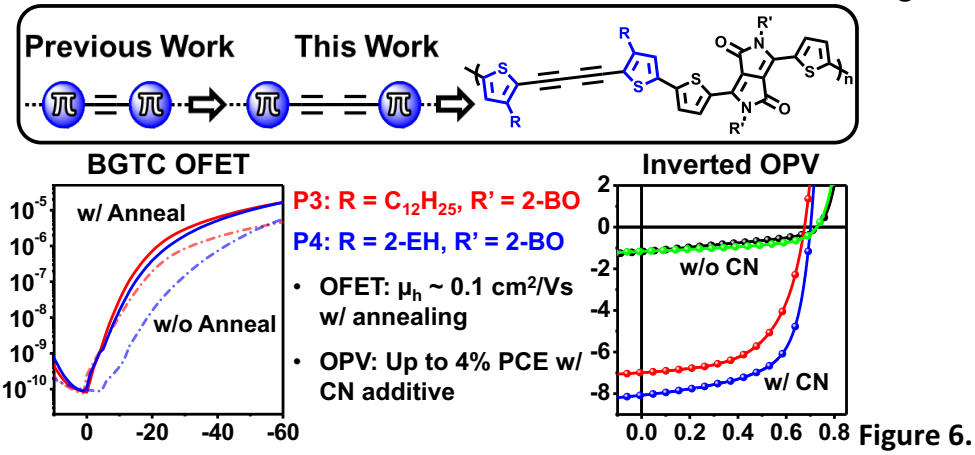

Figure 6.

Caption: Figure 5. Bithiophenesulfonamide Building Block for π-Conjugated Donor-Acceptor Semiconductors. ***Figure 6****. Buta-1,3-diyne Based π-Conjugated Polymers for Organic Transistors and Solar Cells.*

Scientific Achievement

We developed π-conjugated small molecules and polymers based on the new π-acceptor building block bithiophenesulfonamide (BTSA). Molecular orbital computation, optical, electrochemical, and crystal structure analysis illuminate the architecture and electronic structure of the BTSA unit vs. other acceptor building blocks. Field-effect transistors and photovoltaic cells demonstrate that the BTSA is a promising unit for constructing π-conjugated semiconducting materials.

Significance

Sulfonamide Organic Photovoltaic Building Blocks.

Bithiophenesulfonamides (BTSAs) represent a conceptually new building block in the field of organic semiconducting materials. Amide- and imide-based building blocks are widely used and very efficient in-chain acceptor units for polymeric semiconductors. Surprisingly, to the best of our knowledge, sulfonamides have never been explored in this field. That is probably due to the known strongly electron-withdrawing properties and/or tetrahedral geometry of the -SO_2N- group, which was apparently overlooked by researchers working in the field of organic semiconductors. On the other hand, introduction of new electronic units, especially those possessing new unusual and informative structural motifs, are of great interest from a fundamental perspective in advancing the field.

Diacetylenes as Organic Photovoltaic Building Blocks.

The introduction of the π-extended, sterically accessible, and conformationally flexible 1,3-butadiyne fragments into π-conjugated polymer chains opens the way for unique post-film deposition functionalization of thin film materials, including but not limited to UV-light induced cross-linking of polymer chains and topochemical transformation involving diacetylene motif.

Citation

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