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Editorial: High-Performance Organic Thin-Film Transistors

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Editorial on the Research Topic

High-Performance Organic Thin-Film Transistors

Organic electronics have attracted intensive research interest in the past decades (Chen et al., 2020; Yao et al., 2020; Tang et al., 2021). The ever-increasing demand for organic electronics calls for the development of high-performance and high-stability organic thin-film transistors (OFETs). OFETs are considered key components to fabricate flexible and printable devices for promising applications, such as flexible displays, chemical sensors, wearable devices, and radio frequency identification (RFID) tags. The design and synthesis of novel structural materials (such as semiconductors, dielectrics, electrodes, and substrates), as well as the development of efficient interface engineering strategies, would further promote the development of flexible electronics and lay the foundation for their early commercialization (Ji et al., 2019; Ji et al., 2021).

Despite remarkable progress in the development of new materials and relevant applications in organic electronics, some challenges remain, not only on the design and synthesis of novel structural materials (such as π-conjugated small molecule or polymer semiconductors, dielectrics, electrodes, and substrates), but also the development of efficient interface engineering strategies, for the fabrication of high-performance and high-stability devices, and eventually the realization of commercially available products. For example: 1) The need for new π-conjugated semiconductors (small molecule or polymer semiconductors) compatible with polymer dielectric for high-performance devices; 2) The need for polymer dielectric (chemical structures, polarity effects, etc) compatible with commonly used microfabrication technologies for highly integrated miniaturized devices (such as inverter, oscillator, etc); 3) The need for low-voltage and high-current-density high-performance devices (new transistor design or high dielectric constant insulators); 4) The strategies for large-scale device fabrication with uniform performance (new fabrication methods); 5) The need for high-stability devices (atmospheric, thermal).

This Research Topic aims to address the above-mentioned challenges, including one Editorial, one Review and five Original research. The following themes will provide some clues to promote progress in this area. First of all, a novel photoactive semiconductor (named as IDTOT-4F) with an A-π-D-π-A-type configuration is synthesized for optoelectrical device with photo response and optical memory behaviors provided by W. Huang et al. Then, the development of new efficient interface engineering strategies (electrode approach by W. Li et al.; interface modification by T. Li et al.) for high-performance organic thin-film transistors. In addition, new methods for the construction of high-performance and high-stability organic thin-film transistors and relevant optoelectronic applications, which could be listed in the review article by L. Huang et al. and original research in the paper of W. Wang et al. Finally, X. Ren and co-workers reported a low-temperature solution process to fabricate a high-k metal oxide dielectric for low-power OFET applications.

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Overall, the articles published in this research topic cover the device materials for high-performance organic thin-film transistors. We hope that contributions published within this issue will contribute to a new insight into the field of organic electronics, exploring more possibilities of achieving high-performance optoelectronic devices.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

REFERENCES

Chen, H., Zhang, W., Li, M., He, G., and Guo, X. (2020). Interface Engineering in Organic Field-Effect Transistors: Principles, Applications, and Perspectives. *Chem. Rev.* 120, 2879–2949. doi:10.1021/acs.chemrev.9b00532

Ji, D., Li, L., Fuchs, H., and Hu, W. (2021). Engineering the Interfacial Materials of Organic Field-Effect Transistors for Efficient Charge Transport. *Acc. Mater. Res.* 3, 159–169. doi:10.1021/accountsmr.0c00112

Ji, D., Li, T., Hu, W., and Fuchs, H. (2019). Recent Progress in Aromatic Polyimide Dielectrics for Organic Electronic Devices and Circuits. *Adv. Mater.* 31, 1806070. doi:10.1002/adma.201806070

Tang, Q., Zhang, G., Jiang, B., Ji, D., Kong, H., Riehemann, K., et al. (2021). Self-assembled Fullerene (C60)-Pentacene Superstructures for Photodetectors. *SmartMat* 1, e1024. doi:10.1002/smm2.1024

Yao, Y., Chen, Y., Wang, H., and Samorì, P. (2020). Organic Photodetectors Based on Supramolecular Nanostructures. *SmartMat* 1, e1009. doi:10.1002/smm2.1009

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