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Self-doped Conjugated Polyelectrolytes for Organic Electrochemical Transistors

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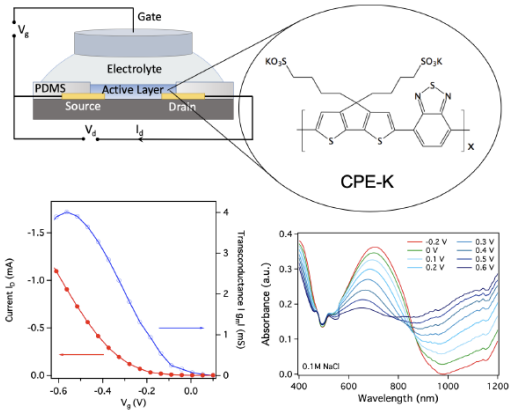
Organic electrochemical transistors (OECTs) have been demonstrated in a wide range of applications such as analyte detection, neural interfacing, impedance sensing and neuromorphic computing. Majority of OECTs use PEDOT:PSS; however, its complex macromolecular structure makes it unable to act as a model material for studying chemical structure - device performance relationships. Other materials should be explored to improve the performance of OECTs. Conjugated polyelectrolytes (CPEs) represent a promising and unique class of materials which are characterized by their conjugated carbon backbone and pendant ionic chains. CPEs have been used in DNA-detection, thermoelectric devices, dye-sensitized solar cells, and as interlayers in organic light-emitting diodes (OLEDs), organic field-effect transistors (OFETs), and organic photovoltaics (OPVs).[1-5] Their electronic and ionic conductivity makes them an ideal candidate for OECT applications. In this talk, I will discuss the development of self-doped conjugated polyelectrolytes (CPEs) as semiconductors for OECTs.[6,7] Anionic CPEs are used as mixed conductor materials for OECTs to replace PEDOT:PSS. CPE-based OECTs operate in the accumulation mode, which allows for much lower energy consumption in comparison to commonly used depletion mode PEDOT:PSS devices. The physical and electrical properties of CPE-K have been fully characterized to allow a direct comparison to other top performing OECT materials. CPE-K demonstrates an electrical performance that is among the best that have been reported in the literature for OECT materials.



References

[1] B. Liu, G. C. Bazan, *Chem. Mater.* 2004, 16, 4467.
[2] P. Taranekar, Q. Qiao, H. Jiang, I. Ghiviriga, K. S. Schanze, J. R. Reynolds, *J. Am. Chem. Soc.* 2007, 129, 8958
[3] J. H. Seo, A. Gutacker, B. Walker, S. Cho, A. Garcia, R. Yang, T.-Q. Nguyen, A. J. Heeger, G. C. Bazan, *J. Am. Chem. Soc.* **2009**, 131, 18220.
[4] H. Zhou, Y. Zhang, C.-K. Mai, S. D. Collins, T.-Q. Nguyen, G. C. Bazan, A. J. Heeger, *Adv. Mater.* 2014, 26, 780.
[5] C.-K. Mai, H. Zhou, Y. Zhang, Z. B. Henson, T.-Q. Nguyen, A. J. Heeger, G. C. Bazan, *Angew. Chem. Int. Ed.* 2013, 52, 12874.
[6] D. Xi Cao, D. Leifert, V. V. Brus, H. Phan, M. S. Wong, G. C. Bazan, N. Koch, T.-Q. Nguyen, *Materials Chemistry Frontiers* 2020, 4, 3556.
[7] A. T. Lill, A. X. Cao, M. Schrock, J. Vollbrecht, J. Huang, T. Nguyen-Dang, V. V. Brus, B. Yurash, D. Leifert, G. C. Bazan, T.-Q. Nguyen, *Adv. Mater.* 2020, 32, 1908120.