Hybrid Inorganic/Organic Systems for Opto-Electronics

Collaborative Research Centre 951

Colloquium Announcement

of the Collaborative Research Centre 951
"Hybrid Inorganic/Organic Systems for Opto-Electronics"

Björn Lüssem

Department of Physics, Kent State University, USA

Doped Organic Transistors for Bio-electronic Applications

Time: Wednesday, July 18, 2018, 3 pm c.t.

Place: IRIS Adlershof, Zum Großen Windkanal 6, 12489 Berlin, Room 007

Collaborative Research Centre 951
Department of Physics
Humboldt-University of Berlin

Email: sfb951@physik.hu-berlin.de
Tel.: +49 30 2093 66374
www.physik.hu-berlin.de/sfb951

Partners

Doped Organic Transistors for Bio-electronic Applications

Vikash Kaphle, Shiyi Liu, Akram Al-Shadeedi, Chang-Min Keum, and Björn Lüssem*

** Department of Physics, Kent State University, Kent, OH, 44242, USA*

Doping organic semiconductors has become a key technology for highly efficient organic LEDs and solar cells[1] and is nowadays used in high-end TV sets and flexible lighting technologies. For organic transistors, the benefits of doping are increasingly acknowledged as well. For example, it has been shown that doping increases the reliability and reproducibility of organic transistors[2]; it allows to design and study new flexible transistor concepts[3,4]; and it minimizes injection losses at the contacts[5].

The organic electrochemical transistor (OECT) is one of the most promising doped organic transistor. OECTs extend the application field of conventional organic transistors toward bio-electronic applications. For example, they have been used to detect various biomolecules[6] and pathogens[7], for electrocardiographic recordings[8], or for in-vivo recording of brain activity[9].

In this presentation, I will discuss our current understanding of the influence of doping on organic transistors. The theory of doped organic transistors will be presented and used to discuss the working mechanism of organic electrochemical transistors[10]. Strategies to optimize the performance of OECTs will be proposed[11] and limits of the current model of OECTs will be discussed.

1. Lüssem, B., Riede, M. & Leo, K. *Phys. Status Solidi Appl. Mater. Sci.* **210,** (2013).
2. Hein, M. P., Zakhidov, A. a., Lüssem, B., Jankowski, J., Tietze, M. L., Riede, M. K. & Leo, K. *Appl. Phys. Lett.* **104,** 13507 (2014).
3. Lüssem, B., Tietze, M. L., Kleemann, H., Hoßbach, C., Bartha, J. W., Zakhidov, A. & Leo, K. *Nat. Commun.* **4,** 2775 (2013).
4. Lüssem, B., Keum, C.-M., Kasemann, D., Naab, B., Bao, Z. & Leo, K. *Chem. Rev.* **116,** (2016).
5. Ante, F., Kälblein, et al. *Small* **7,** 1186 (2011).
6. Kergoat, L., Piro, B., Simon, D. T., Pham, M. C., Noël, V. & Berggren, M. *Adv. Mater.* **26,** 5658–5664 (2014).
7. He, R.-X., Zhang, M., Tan, F., Leung, P. H. M., Zhao, X.-Z., Chan, H. L. W., Yang, M. & Yan, F. *J. Mater. Chem.* **22,** 22072 (2012).
8. Campana, A., Cramer, T., Simon, D. T., Berggren, M. & Biscarini, F. *Adv. Mater.* **26,** 3874–3878 (2014).
9. Khodagholy, D., et al. *Nat. Commun.* **4,** 1575 (2013).
10. Bernards, D. A. & Malliaras, G. G. *Adv. Funct. Mater.* **17,** 3538–3544 (2007).
11. Kaphle, V., Liu, S., Al-Shadeedi, A., Keum, C.-M. & Lüssem, B. *Adv. Mater.* **28,** (2016).