How "impurity" molecules turn plastic into electrical conductors – mechanism of electrical doping in organic semiconductors resolved

The electrical conductivity of inorganic semiconductors, such as silicon, which prevail in today's microelectronic devices, can be tuned through the controlled incorporation of "impurity" atoms – a process called doping. Organic electronics, based on organic semiconducting materials, is an emerging alternative technology. Norbert Koch (**IRIS Adlershof**) and his colleagues at Humboldt-Universität and the Helmholtz-Zentrum Berlin für Materialien und Energie GmbH have revealed the mechanism that governs the doping of organic semiconductors with dopants, i.e. "impurity" molecules. In contrast to previous suggestions that rely on direct electron hopping from one molecule to another, inter-molecular charge-transfer complexes between organic semiconductor and dopant are formed. These can generate mobile charge carriers after (thermal or optical) excitation, which in turn increases the electrical conductivity of the material. These new insights pave the way for the development of more potent molecular dopants to improve the efficiency of organic electronic devices.

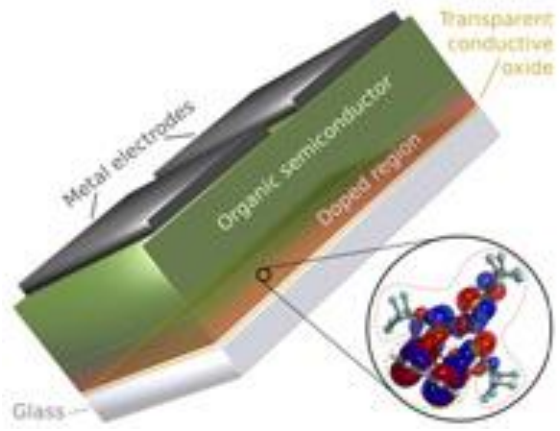

Fig.: "Organic/dopant complexes": Cartoon of a typical organic electronic device consisting of organic semiconductor layers and conducting electrodes. The magnification shows complexes formed by organic semiconductor molecules (circled in red) and molecular dopants (green line), which need to be excited to generate mobile charge carriers. (Image © by G. Heimel)

Intermolecular Hybridization Governs Molecular Electrical Doping

I. Salzmann, G. Heimel, S. Duhm, M. Oehzelt, P. Pingel, B. M. George, A. Schnegg, K. Lips, R.-P. Blum, A. Vollmer, N. Koch

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