Organic semiconductors: Physics and device applications

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Organic semiconductors with conjugated electron system are currently investigated intensively, both because the basic physics are little understood and because of attractive application possibilities, such as flat-panel displays based on organic light emitting diodes (OLED). I will first give a brief overview about the characteristics of this new class of semiconductors.

I will then discuss results of a comprehensive study of controlled n- and p-type doping of various molecular organic materials. In contrast to classical silicon technology where controlled n- and p-type doping has always been a standard technique, the organic materials are usually prepared in a nominally undoped form.

We have further shown that these electrical doping concepts can be successfully applied in devices: the concept of molecular doping allows to realize OLED devices with the highest efficiencies reported so far, exceeding the efficiency of GaN devices.