"Hybrid Materials for Efficient Energy Generation and Information Technologies"

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Title: Synthesis of optimized hybrid semiconductor components

Hybrid devices made from organic and inorganic semiconductors have great promise as they combine advantageous properties of these two materials classes ideally in a synergistic fashion. However, in order to harness this great potential both components have to be tailored with regard to their electronic and optical properties. This requires on the one hand a fundamental understanding of the underlaying processes at the organic/inorganic interface yet on the other hand the ability to tune the physical properties of both materials. The latter is of particular importance as it allows for proper energy level alignment and absorption/emission tuning in order to optimize the performance of the hybrid devices under investigation.

The aim of the PhD thesis is to synthesize various organic semiconductor components with specific electronic characteristics (HOMO/LUMO positions) and optical properties (excitation/emission). For this purpose, the PhD student will develop modular synthetic routes to new π-conjugated organic semiconducting materials involving state of the art synthesis, purification, and analysis methods. In addition, the molecules' redox properties (oxidation/reduction potentials) as well as their optical features (absorption and emission spectra, quantum yields), even in the charged (oxidized/reduced) state (spectroelectrochemistry) will be investigated. Furthermore, the self-assembly in the bulk and at inorganic interfaces will be studied. Within the PhD thesis the student will therefore be able to deduce important structure-property relationships, which will lead to an iterative optimization of the organic component for these novel hybrid devices.