Abstract

The development of new materials was and remains one of the most important disciplines of chemistry. There's not only a demand for new inorganic, organic and biochemical materials but also for hybrid materials. These are materials based on two of these material classes. The characteristics of all material classes such as conductivity, absorption, hardness, plasticity, magnetism, luminescence or biological properties, can be used by well-directed combination of these. For example, if the hardness and conductivity of an inorganic material is combined with the plasticity of an organic polymer, printable electronics may become possible. New materials are interesting not only because of potential applications, but also for basic research, in order to get a better understanding in various mechanisms.

In the present work the development of new hybrid materials on the basis of silicon nanoparticles (Si-NP) and crosslinkable benzothiadiazol monomers is presented. Triphenylamines (TPA) are used as hole conducting units for derivatization of the new materials. Through well-directed variation of the substituents in *para* positon of the triphenylamines, its oxidation potentials can be changed and adapted.

First the Si-NP are analyzed in pure form and afterwards functionalized with triphenyl-aminedimers (TPD). In order to optimize the reaction conditions, primarily small molecules are attached to the Si-NP. Afterwards the nanoparticles are functionalized by TPD's with optimized reaction conditions. A concept is set up, in which the transport of the positive charge carriers from the organic shell (TPD derivatives) to the Si-NP is examined by the adjustment of the energy levels of both material classes. The change of conductivity is investigated by organic field effect transistors.

In the second part of the work crosslinkable benzothiadiazol-monomers with TPA and oxetane units are synthesized and used in two-layer solar cells. The oxetane groups permit transverse crosslinking, resulting in an insoluble film and thus making processing of the next layer possible. The two-layer structure allows examining physical fundamentals such as exciton diffusion length, interference-maximum of the electrical field and the conductivity.