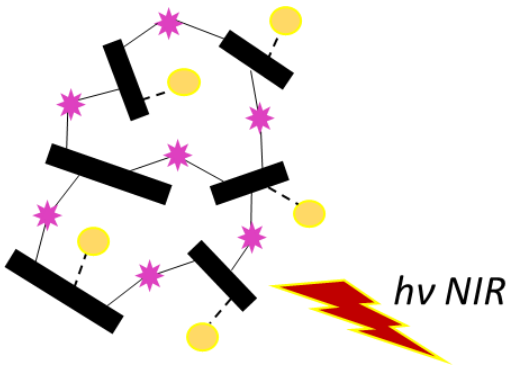
JUSTUS-LIEBIG-
UNIVERSITÄT
GIESSEN

MASTER THESIS
in Chemistry or Advanced Materials

Functional 2D and 3D Random Networks of Nanocarbons for Plasmonics and Optoelectronics

Hybridizing nanocarbons, such as carbon nanotubes (CNT) or graphene-based materials (GBM), with an active material is a powerful strategy towards designing next-generation functional materials for environmental and sustainable energy applications. While research on nanocomposites, created by dispersing the nanocarbon into polymer or ceramic matrices, began almost immediately after the popularization of CNT and GBM in 1991 and 2004, respectively, nanocarbon hybrids are a relatively recent addition to the family of composite materials.[1] In contrast to nanocomposites, which typically combine the intrinsic properties of both compounds, nanocarbon hybrids additionally provide access to both a large surface area required for gas/liquid-solid interactions and an extended interface, through which charge and energy transfer processes create synergistic effects that result in unique properties and superior performance.

In one available project, the Master Student will develop and characterize 2D covalent networks of single walled CNT (SWCNT) with specific chromophores, which will be, in a second step, combined with plasmonic gold nanoparticles. An enhancement of the NIR-emission characteristic of SWCNT is expected, through the promotion of highly efficient energy transfer processes from the dye to the nanotubes, prompted by the presence of the gold nanoparticles.[2]



In a second available project, analogous 3D networks of GBM and photoactive molecules will be prepared and studied for their optoelectonic properties, aiming at the incorporation in working devices, such as solar cells and photodetectors.

The project implies the collaboration with other research groups in Germany and outside, in terms of materials provision and characterization. In particular, the group of Dr. A. Setaro at the Freie Universität Berlin for the incorporation of gold nanoparticles and the study of the plasmonic properties and the group of Dr. S. Bähring at the University of Southern Denmark for the provision of photoactive molecules will be involved.

Supervisor:
Dr. Teresa Gatti
teresa.gatti@phys.chemie.uni-giessen.de

References

1. Shearer, C.J. et al. “Application and future challenges of functional nanocarbon hybrids” *Adv. Mater.* **2014**, *26*, 2295
2. Glaeske, M. et al. “Plasmon-Assisted Energy Transfer in Hybrid Nanosystems” *Phys. Status Solidi-Rapid Res. Lett.*, **2018**, *12*, 1800508