

## Tailored Light Applications on the nanoscale

Supervisor: Prof. Dr. rer. nat. habil. Andreas Waag,  
TU Braunschweig (TU-BS), Institut für Halbleitertechnik (IHT)

Co-Supervisor: Dr.-Ing. Sönke Fündling,  
TU Braunschweig (TU-BS), Institut für Halbleitertechnik (IHT)

Project ID: A5

With the development of gallium nitride technology, which was awarded in 2014 the Nobel Prize for Physics, highly efficient light emitting diodes (LED) became available, emitting light throughout the visible and UV spectral range. High Power LEDs have dimensions of typically 1 mm<sup>2</sup> and can be used for almost any lighting purposes. However, such LEDs can be manufactured as regular arrays of NanoLEDs, where each NanoLED acts as a light-emitting diode, with which objects can be illuminated with accurate position control. The project targets on LED dimensions in the sub – micron to nanometer range. With respect to applications, existing nanowire sensors for highly selective gas sensors will be further developed through the promotional program "tailored light". In this sense laterally structured planar LEDs with a customized design and are provided with electrodes for the subsequent application of semiconductor nanowires (see Figure).

The combination of nanowire sensors with LEDs has the advantage that the activation of the sensor can be ensured via light and not anymore via continuous heating, as in conventional systems. The absorption of light in the nanowires generate electron-hole pairs, which then lead to the desorption of adsorbed molecules on the surface of the sensor. Thereby, the surface is refreshed again whereas the detection sensitivity of the sensor is maintained. The LEDs can also be operated in pulsed mode, so the time-dependent response of the sensor can reveal information on the dynamics of the adsorption and desorption processes. By a special surface functionalization of the semiconductor nanowires the system can be adjusted to the molecules to be detected. This requires close collaboration with research groups from the electrical engineering, chemistry and biochemistry, respectively.

The central work package of this project will be the preparation and analysis of systems including nanoLED arrays for tailored lighting and the nanowire sensor system.



Schema eines Nanodraht-Sensors mit lateral strukturierter LED

This is a PhD-project of Tailored Light. Tailored Light is a coordinated PhD-programme of the Hanover Centre for Optical Technologies from the Leibniz Universität Hannover together with the Hochschule Hannover, the Laser Zentrum Hannover, the HAWK Hildesheim/ Holzminden/ Göttingen, the TU Braunschweig and the TU Clausthal.

Students interested in this or another project of Tailored Light can apply for fellowships. Have a look at [www.tailored-light.uni-hannover.de](http://www.tailored-light.uni-hannover.de) for details.

