The **DOTSENSE** consortium has succeeded in developing a new technology platform for integrated all optical sensor systems based on III-nitride quantum dot (QD) and nanowire (NW) structures.

The chemically induced variation of the photoluminescence intensity of III-nitride NW heterostructures (for the detection of gases) and of InGaN/GaN QD superlattices (for operation in liquids) allows the optical detection of changes in the chemical environment. Excitation and detection of the nanostructure photoluminescence can be excited and readout with commercially available LEDs and photodetectors (**Figure 1**).

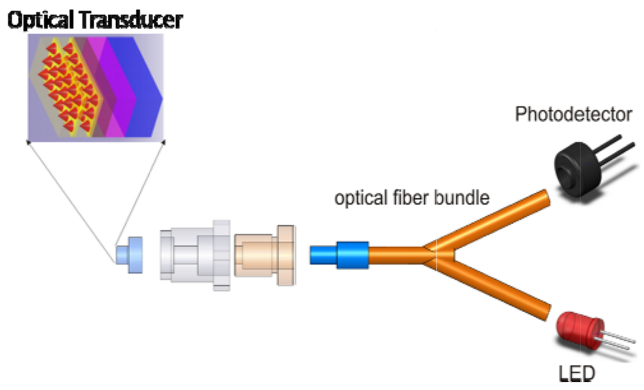

Figure 1
Schematic setup of **DOTSENSE** integrated optical chemical sensor system. Chemically induced changes in the photoluminescence characteristics of the nano-optical transducer element (InGaN/GaN QD superlattice or InGaN/GaN NW hetero-structure) are detected.

For **nanowire sensor devices** changes in the non-radiative surface recombination rate due to absorption of gas molecules allow the detection of specific gases with very high sensitivity and short response and recovery tomes already at room temperature (e.g. < 20 ppm H_2, cf. **Figure 2**).

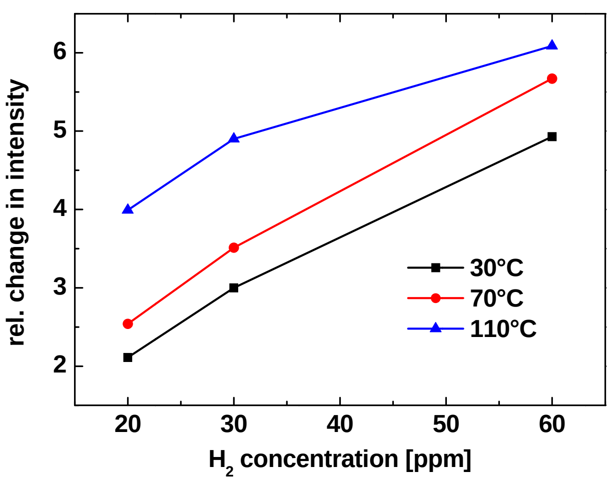

Figure 2
Response of the integrated sensor system to H_2 at different transducer temperatures.

Polar **InGaN/GaN quantum dot superlattices** show excellent transducer properties for pH detection in liquids. The emission in the range of 420 nm upon excitation with a commercial 360 nm LED shows a pronounced sensitivity towards changes in the solution pH. **Figure 3** shows a pH-measurement carried out with an InGaN/GaN QD based all-optical demonstrator system.

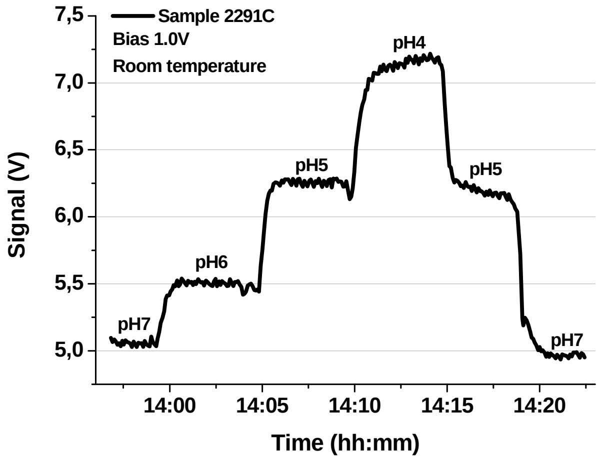

Figure 3 Response of the integrated sensor system with InGaN/GaN QD transducers to pH-changes in an electrolyte solution.

The **DOTSENSE** consortium has identified several new application fields for this innovative sensor technology. High sensitivity and short response and recovery times at low operation temperatures are promising features of **DOTSENSE** nano-optical sensor systems.

Recent Publications

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