Using experience from explosives detection in development of biosensors based on nanomechanical responses.

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In the Danish research project Xsense [1] we have for the past four years focused on the development of methods to detect military explosives in air – primarily for use in demining. We have developed four miniaturized sensors based on different detection principles: calorimetry [2], cantilever-based sensing [3], colorimetry [4] and Surface Enhanced Raman spectroscopy (SERS) [5]. By combining four independent measurement techniques it is possible to obtain more reliable explosives detections.

The work on explosives detection has forced us to focus more on reliability and high throughput sensing. Several of our sensor technologies had to be significantly modified in order to be able to generate sufficient data for statically robust analysis.

For example, cantilever-based sensors are normally read-out by an optical leverage technique know from Atomic Force Microscopy. However, this method is rather slow and only allows measurements on a handful of cantilevers simultaneously. We instead use the optics and mechanics from a normal DVD-player. Hereby, thousands of cantilevers can be read in seconds. Furthermore, the rotational platform allows us to explore centrifugal microfluidics as well [6].

We now apply the DVD platform as well as the principle of combining several independent sensor technologies to applications in diagnostics/prognostics and environmental monitoring. This includes breath analysis of patients with lung diseases, detection of specific biomarkers in blood and monitoring of organic contamination of waste water. Our aim is to demonstrate robust, reliable and high throughput sensing in real-life samples – in close collaboration with industrial partners.

We will describe our journey towards high-throughput read-out from nanomechanical sensors and discuss latest results on our new bio-sensing projects.

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