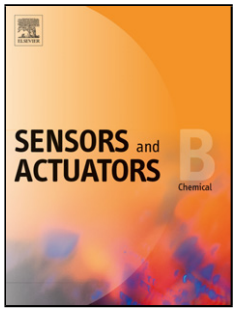

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Optical Readout of a Nanoparticle Based Sensor by Cavity Ring-Down Spectroscopy

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Highlights:

- Cavity Ring-Down Method was used for sensitive optical sensor readout.
- Plasmonic nanoparticles immobilized within a microfluidic cuvette act as sensors.
- Physical effect: Plasmonic resonance shift of metallic nanoparticles in dependence on changes in refraction index.
- Enables in-situ sensitive optical readout in real-time.
- DNA-sensing demonstrated as proof-of-principle.

Abstract

We combine the plasmonic properties of metallic nanoparticles enabling a label-free bioanalytical approach with the cavity ring-down method (CRD) in a miniaturized fluidic device as a sensitive and fast optical photon lifetime measurement. Nanoparticles (Ag triangles and Au nanodots) are immobilized within a specially designed microfluidic chip (MFC) that is situated inside an optical cavity. Our approach allows to measure absorption / loss changes of 0.02% – well below the typical detection limit (< 1%) of conventional spectrometers. The proof of principle is demonstrated by sensing refractive index changes of the solution inside the chip. Furthermore, a first bioanalytical application example is presented. Therefore, the binding of $2x10^8$ DNA sequences from the phytopathogene microorganism *Phytophthora kernoviae* onto nanoparticles functionalized with complementary DNA molecules could be detected.

1. Introduction:

In recent years efficient optical methods for the detection of biomolecules have been established. Besides different fluorescence labeling techniques [1] for biochip-related or cell applications, a number of label-free methods have been developed. For example, different Raman detection schemes like SERS, TERS, or CARS [2, 3] have been used. Alternatively, surface plasmon resonance (SPR) sensing [4] shows a great potential for the detection of biomolecular interactions. Compared to SPR, localized surface plasmon resonance (LSPR) based on plasmonic nanostructures provides a novel kind of sensor