**Boosting surface plasmon resonances of thin golden film by bio photonic crystals**

M. Gilic1, M. Ghobara1 and L. Reissig1

1Institute for Experimental Physics, Freie Universität Berlin, Arnimallee 14, 14195 Berlin

martina.gilic@fu-berlin.de

Diatoms are unicellular biomineralized algae which possess a biosilica shell with a 2D periodic pore structure. Due to their unique physical, chemical and photonic properties, diatoms found numerous application in biochemical sensors contributing to their ultra-high sensitivity [1, 2]. As substrates for Surface Enhanced Raman Spectroscopy (SERS) they proved to be capable of concentrating analyte molecules on their surface as well as assembling metal nanoparticles at pore rims which lead to more controllable hot spot creation. It has been suggested that diatoms enhance the SERS signal additionally with guided mode resonance due to their photonic crystal – like properties. However, current studies are limited to coating diatoms with noble nanoparticles or non-uniform golden films, which hampers interpretation regarding their photonic structure contribution and leads to unsatisfactory reproducibility.

Here we present biosilica substrates based on diatom frustules coated with a uniform 10 nm thick layer of gold as a candidate for highly reproducible SERS substrates with high enhancement factors. The uniform films spread over the periodic frustule structure enable the study of photonic properties of periodical pore arrays and their role in enhancing optical sensitivity. Rhodamine 6G is used as a typical Raman probe molecule. Our results show that substrates with a gold film over diatom monolayers improve SERS detection of R6G by several times compared to substrates with a gold film on glass. The reproducibility of the measurement was verified with Raman mapping. Surface morphology and the fine structure of the diatoms were investigated with Scanning Electron Microscopy, confirming structural integrity for an expanded analytical study.

REFERENCES:

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