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OMCVD AuNP Grown on Polymer Substrates: An approach Towards Mass Fabrication of Biosensors

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Organometallic chemical vapour deposited (OMCVD) gold nanoparticles (AuNPs) can be successfully used for biosensing. For the sensing mechanism an absorption feature, the localized surface plasmon resonance (LSPR), is implemented. Typically in this bio-sensing approach is monitoring the changes in the peak position of the LSPR via absorption spectroscopy during a highly specific binding reaction in real time. For this purpose a recognition site is immobilized on the nanoparticle via sulphur chemistry. The target molecule then recognises its host molecule and binds to it changing the dielectric constant of the layer on the AuNP which is detected by the LSPR.
However, if the AuNPs are only loosely connected to the substrate they tend to form 2D clusters on the surface of the substrate as soon as a liquid comes into contact with them and then they deliver a false, irreversible shift in the LSPR. Therefore only AuNPs which are stably immobilized on a transparent substrate can be used for sensing purposes.
In a first successful attempt we have used the sparsely available polar –NH groups of a monolayer of hexamethyldisilazane (HMDS) covalently attached to glass substrates to nucleate and grow stable AuNPs with the (trimethylphospine)methylgold ((CH3)3P]AuCH3) precursor.
Now we present stable OMCVD AuNPs on oxygen plasma treated polystyrene, stepping towards technology allowing mass fabrication of AuNP-substrates. The polar -OH groups forming during the oxygen plasma process serve as nucleation sites for the AuNPs.
The optimum conditions of the plasma treatment are determined: how to achieve the largest possible amount of –OH groups without changing the optical quality of the polymer. The shift in the LSPR, the bulk sensitivity of the AuNPs and first bio-sensing experiments with the biotin-streptavidin system are presented.

Primary author: Prof. MITTLER, Silvia (University of Western Ontario)

Co-authors: Prof. GILROY, Joe B (University of Western Ontario); Mr PAQUETTE, Joseph A. (University of Western Ontario); Mrs KANDEEPAN, Sivayini (University of Western Ontario)

Presenter: Prof. MITTLER, Silvia (University of Western Ontario)

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