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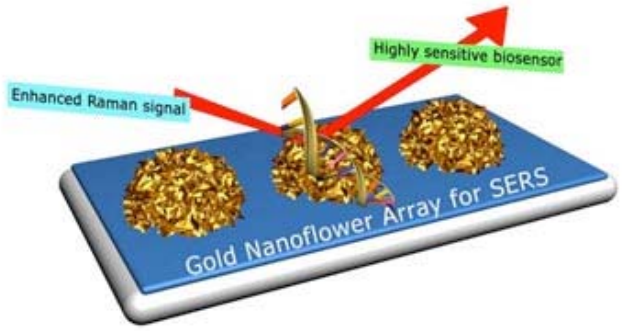
LAB TALK

Jun 12, 2009

Biosensing nanoflowers in bloom

The morphology of metal nanostructures has a particularly remarkable effect on the application of surface-enhanced Raman scattering (SERS) combined with the strongly localized surface-plasmon resonance characteristics of gold and silver. Although it is known that silver shows better SERS enhancement, gold is also favoured as a SERS template due to its chemical stability and compatibility with various target molecules and buffer solutions.



Nanoflower array configured for biosensing

A controllable flower-like gold nanostructure (nanoflower) array for SERS has been fabricated by Yang-Kyu Choi and Bongsoo Kim's group at KAIST, Korea, by incorporating the top-down approach of conventional photolithography and the bottom-up approach of electrodeposition. The team has used its well ordered nanoflower design as a SERS template to successfully detect various chemical and biomolecules without labelling.

Patterning and growth

The reported nanofabrication process consists of two steps: lithography and electrodeposition. Photolithography on the gold film defines the size and position of a target nanostructure on a wafer-scale substrate with the high accuracy of a computer-aided design (CAD) tool. The electrodeposition of $HAuCl_4$ on the patterned gold film meanwhile provides a time- and cost-effective synthetic method of creating a nanoscale flower-like gold structure without a lithographic resolution limit. This type of combined method incorporating top-down and bottom-up techniques has been developed to overcome the limits of previous approaches employing nanostructured templates in terms of high-throughput as well as position and size-controllability.

In the group's recent study, the SERS signal dependence on the surface morphology of the gold nanoflower was investigated by changing the electrodeposition time of nanostructure's synthesis. Furthermore, various molecules, such as brilliant cresyl blue (BCB), benzenethiol (BT), adenine monomer and DNA, were detected with high sensitivity and reproducibility

through SERS. In the near future, this well ordered nanostructure, providing strong SERS enhancement, can be monolithically implemented onto a lab-on-a-chip-based total analysis system for label-free chemical and biomolecular detection processes with the aid of MEMS technology because the nanoflower fabrication method is based on a top-down lithography process. The compatibility of the combined method is strongly advantageous in terms of monolithic system integration and further applications.

The researchers presented their work in *Nanotechnology*.

About the author

Ju-Hyun Kim is a PhD student in the Nano-Oriented Bio-Electronics Lab (NOBEL) at the School of Electrical Engineering and Computer Science, KAIST, Korea, under the supervision of Prof. Yang-Kyu Choi. His research interests are focused on fabrication methods and possible applications of hierarchical trans-scale 3D structures with the combined techniques of top-down and bottom-up processing.