Optically Trappable Nano-probes for Surface Enhanced Raman Scattering: Detection of Trace Quantities of Drugs in Cells

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The enhancement of local field intensity due to local plasmon resonances near nanoscopically textured metal structures leads to many fascinating optical effects. One of them is the Surface Enhanced Raman Scattering (SERS) which has been established as a powerful spectroscopic technique to chemical analysis, combining high sensitivity with multi-component structural information. Our group widely used this technique to study photoactive drugs and their complexes with biological macromolecules.

In this work, we report the development and characterization of micron sized dielectric beads with metal colloids attached to their surface. The metalized beads were sufficiently transparent enabling optical trapping while the presence of metal islands provides the SERS. This highly efficient probe can be placed and scanned with nano-metric accuracy outside as well as inside living cells. The process to create such probes is described including discussion of various parameters that are critical in achieving the desired results. Additionally, their use is demonstrated by detecting low quantities of photoactive drugs and their derivatives (hypericin, emodine) in aqueous solution and in a cell membrane.

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