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Surface Enhanced Stimulated Raman Spectroscopy using CW sources (I)

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We successfully demonstrate Surface Enhanced-Stimulated Raman Scattering (SE-SRS) using Oxonica (now Cabot securities) nanoparticles for particle concentrations as low as 10 picomolar using peak power densities that are three-to-four orders of magnitude smaller than that required for conventional SRS. These reduced incident powers are possible because the laser field is significantly enhanced within the gold nanoparticle dimer crevices, where the molecular species of interest is attached. Diminishing the incident laser power requirements meant that CW lasers of low power focused to tens of microns in diameter can be used to generate SE-SRS; enabling the detection of nanoparticles at picomolar concentrations. Because of the concentration dependence of SRS, the technique should be applicable to molecular tracking of species of higher concentrations (e.g. the nanomolar or micromolar concentrations of signaling proteins in cells).
In particular, SE-SRS is demonstrated for two different nanoparticle types, using two Ti:sapphire lasers producing a pump (785 nm, 100 mW) and appropriately varying probe/Stokes beams (860 –870 nm, 120 mW). The Ti-Sapphire lasers are co-pumped by a 10 W low noise 532 nm Millenia laser. Pulsed SE-SRS is also demonstrated using a Coherent Chameleon Ultra laser for the Stokes/probe (863-871 nm) beam and a Coherent Ultra II as the pump laser (785 nm). In both cases lock-in techniques are used to extract the small signal (1 in 10^8) successfully.

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