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SERS-Encoded Metallic Nanoparticles Based on Aryl Diazonium Chemistry for Raman Imaging and Nanosensing

Sensing and imaging technologies relying on nanoscale tools have attracted increasing attention over the past decades. Among the various nanoprobe developed for bioimaging, optically encoded metallic nanoparticles (NPs) are particularly promising as they act as efficient Raman signal amplifiers and generate intense surface-enhanced Raman spectroscopy (SERS) signatures. In recent years, SERS tags have emerged as a powerful alternative to fluorescent probes. Unlike the broad emission bands of fluorophores, SERS tags display sets of sharp and well-defined spectral features, which minimizes spectral overlap and enables outstanding multiplexing capabilities.

In this talk, we will present the use of gold or silver nanoparticles encoded with aryl diazonium salts as nanotools for Raman imaging and sensing¹⁻⁴. Compared with conventional thiol-based self-assembled monolayers used in SERS tag fabrication, aryl diazonium salts form robust covalent bonds with metallic surfaces, generate intense SERS fingerprints, and enable the formation of multifunctional polyaryl layers that can host multiple Raman reporters and provide sites for post-functionalization. This strategy has enabled the development of SERS tags for bioimaging as well as anticounterfeiting inks compatible with additive printing techniques such as inkjet printing. We will also describe a label-based sensing approach employing nanoparticles functionalized with different SERS-encoded aryl diazonium salts. Using a dual-probe SERS assay, this strategy enables the development of an advanced ratiometric glucose sensor for accurate monitoring in clinical settings. Together, these examples highlight the potential of this new generation of SERS-encoded nanoparticles for optical nanosensing, anticounterfeiting, and bioimaging (see Figure 1).

References

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Figures

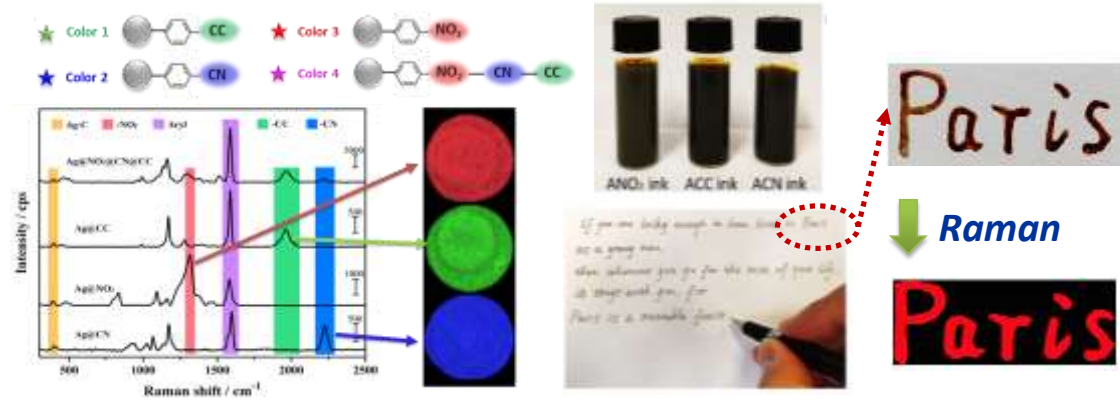


Figure 1: Illustration of SERS-encoded NPs functionalized by diazonium salts along with their SERS spectra and images (left-hand side). Picture of the anti-counterfeiting inks and corresponding optical and Raman images (right-hand side).