Novel nanoarray SERS substrates for high sensitivity biomedical pathogen sensing and classification

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Development of diagnostic methods for rapid and sensitive identification of viruses and other biomedical pathogens is essential for the advancement of therapeutic and preventive intervention strategies necessary to protect public health. Current diagnostic methods for viruses in particular, e.g. isolation, PCR, antigen detection and serology, are time-consuming, cumbersome, or lack the required sensitivity. We have investigated the use of aligned Ag nanorod arrays, prepared by oblique angle vapor deposition (OAD), as surface-enhanced Raman scattering (SERS) substrates for the identification and quantization of viral pathogens. The OAD method of substrate preparation facilitates the selection of nanorod size, shape, density, alignment, orientation, and composition, while the procedure is reproducible and relatively simple to implement. The current talk will address the fundamental nanostructural design of metallic nanorod arrays and their influence on SERS enhancement, as well as the development of a spectroscopic biosensor assay for virus detection based on these unique nanostructured SERS probes. We will also present results of multivariate statistical analyses on the SERS spectra of different viral and bacterial species that indicate that it is possible to identify, differentiate and classify viruses and other pathogens based on their intrinsic SERS spectra, even down to the strain level.