# Characterization and Application of Silver Nanorod SERS Substrates as Viral Biosensors

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Surface Enhanced Raman Scattering (SERS) spectroscopy is being increasingly utilized in the sensing, detection and identification of biomolecules and biological agents, such as bacteria and viruses, which are present in extremely low concentrations. In this study we report the capability to detect extremely low quantities of viruses with sensitivity and specificity. The prerequisite to such detection is the fabrication of SERS substrates that can provide high enhancement factors so as to enable the detection of extremely small quantities of the afore mentioned specimens. We have previously shown that silver nanorod substrates prepared using the glancing angle vapor deposition (GLAD) technique are capable of providing extremely high enhancement factors (~$10^8$) at Near Infra Red wavelengths (785 nm) for a standard reporter molecule 1,2 trans-(bis)pyridyl-ethene (BPE). The physical characteristics of the substrate such as the size and shape of the nanorods, orientation and the spacing between the nanorods can be modified using the GLAD technique. The applicability of this substrate to the detection of bioagents has been investigated by looking at low quantities (~0.5uL) of several viruses such as Adenovirus, HIV, Rhinovirus and Respiratory Syncytial Virus (RSV) in the presence of different media, different states of activity and concentrations. In addition to the SERS spectra of the above, the polarization dependence of the SERS enhancement of the silver nanorod substrate has been studied by measuring the SERS response as a function of the angle between the nanorods and the direction of the polarization vector.