Seminar

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Institute for Plasma Research

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Title: A novel approach for improving SERS-based molecular detection efficiency

Speaker: Dr. Mahesh Saini
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Date: 23rd August 2022 (Tuesday)

Time: 03:30 PM

Venue: Join the talk online
https://lobby.ipr.res.in/MaheshSaini

Abstract

Surface-enhanced Raman scattering (SERS) is a commonly used sensing technique in which inelastic light scattering by molecules is greatly enhanced (by factors up to 108 or even larger) when the molecules are adsorbed onto corrugated metal surfaces such as silver or gold nanoparticles (NPs) via local surface plasmon resonant (LSPR) coupling. LSPR coupling is greatly affected by the geometrical and optical aspects of metal nanoparticles and their surrounding medium, viz. shape, size, refractive index, etc. In addition to above, there is a novel approach to improve the SERS-based detection efficiency by the strong plasmonic coupling between vertically stacked layers of metal-film and metal-nanoparticles isolated by a dielectric spacer layer.

In this study, we introduce all-sputtered-grown Ag-NPs and Al film based SERS substrate for manifold improvement in the SERS intensity. During the study, native oxidation of Al film is employed as a dielectric spacer layer. However, due to poor control over the thickness of naturally grown dielectric layer, Al_2O_3 and PTFE were also deposited on Al films using magnetron sputtering. Moreover, the thickness of dielectric spacer layer also plays an important role in SERS efficiency. Experimental findings reveal that strong plasmonic coupling between Ag-NPs and Al-film leads to an improvement of ~15 and ~25 times in SERS-based detection efficiency of crystal violet (CV) dye with Al_2O_3 and PTFE as dielectric layers, respectively compared to Ag-NPs directly deposited on Si substrates. This study pave a way towards detecting ultralow concentrations of trace molecules like adulterants in foods, pesticides in fruits and vegetables, forensic applications, exploring biological substances like blood, saliva, urine for identifying different diseases like malaria, diabetes, cancer etc.