Title: Excitation wavelength dependence on SERS and on Plasmonic Photocatalysis

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The comparison of the performance of substracts of different nature (imobilized and dynamic) must consider nature and optical features? And in plasmonic photocatalysis, the generation of electron-hole pair should be dependent of the excitation energy?

The SERS enhancement factor (SERS-EF) is one of the most important parameters that characterizes the ability of a given substrate to enhance the Raman signal for SERS applications. The comparison of SERS intensities and SERS-EF values across different substrates is a common practice to unravel the performance of a given substrate. It is proposed that if we compare substrates of very distinct nature and optical properties it may lack significance. It is specifically shown that the SERS-EF values for static substrates (e.g. immobilized metallic nanostructures) cannot be compared to those of dynamic ones (e.g. colloidal metal nanoparticle solutions). The most representative experimental results concerning the dynamic substrates have been supported by generalized Mie theory simulations, which are tools used to describe the substrate complexity and the microscopic information not usually taken into account.

In addition, titanium dioxide (TiO2) is an advantageous material in catalytic photodegradation due to its low cost, high stability, and considerably higher efficiency when compared to other semiconductors. However, the need for artificial radiation sources in the UV range is a limitation to its use in wastewater remediation. In this context, Localized Surface Plasmon Resonance (LSPR) has been shown to enhance the photoexcitation of charge carriers in the semiconductor. The investigation of catalytic photodegradation of phenol solution under distinct excitation by UV-visible or just visible radiation, employing three TiO_2 based plasmonic catalysts, was conducted. Discrete dipole approximation simulations were carried out in order to verify the electric field enhancement and penetration at the semiconductor surface of each plasmonic catalyst.