Wavelength dependence of the enhancement in SERS substrates

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Abstract

Surface enhanced Raman scattering (SERS) has emerged in recent years as an important tool for the ultrasensitive detection of many types of analytes, like food contaminants, explosives, and biomolecules. Research areas in the field of SERS include, for example, the investigation of fundamental aspects (related to the signal amplification mechanism), the fabrication of reliable and efficient substrates and the integration with concentration and separation methods like microfluidics [1].

The efficiency of a substrate is commonly evaluated using the enhancement as a figure of merit: its wavelength dependence is an important piece of information, since it shows in which spectral region a SERS substrate performs better. However, its experimental determination in a wide range of wavelengths is not trivial and often people refer to more easily measurable parameters like extinction, although near- and far- field properties are in general considered to be non-correlated [2]. Here we present and discuss, for some plasmonic nanostructures, the experimental determination of the SERS enhancement as a function of the excitation wavelength and its comparison with the far-field properties. Moreover, with a case study, we shall show that the spectral region with the highest enhancement does not necessarily corresponds to the region where spectra are collected with the highest sensitivity (e.g. lower detection limit), since other factors (mainly the instrument sensitivity) come into play.

[1] R. Pilot et al. *Biosensors* 2019,*9*(2), 57.
[2] Kleinmann et al. J. Am. Chem. Soc. 2013, 135, 301−308.