

How equivalent are conditions for Raman scattering of molecules deposited on a tip or contacted surface in TERS configuration

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Proposed concept of Raman probe for scanning probe microscopy [1] and realization of an internal standard for TERS [2] are based on functionalized tips covered by a Raman active material. Such a structure raises the question about the relation of fields at the tip apex and contacted surface to compare signals we should expect from materials at those two points. In spite of very close proximity of those two points asymmetry of the structure due to very different shape of interacting parts results in different conditions of the field distribution and nonequivalent positions for coverage.

Simple dipole model was used for the analysis of the ratio of fields at the tip apex and contacted surface. Interaction of two parts was accounted by the interaction of the dipole generated at the tip with its image in the surface. Interesting feature of metallic surfaces created by plasmonic effect was found. This effect decreases the dependence of the field's ratio on the tip-surface separation and allows to manage this dependence by the used wavelength. The influence of the finite size of the tip was accounted in the frame of this dipole model.

The same model was spread for the case of a rough surface with a protrusion. This situation differs from the case of a flat surface due to lightning-rod effect at curved shapes.

[1] E. Bortchagovsky and U. Fischer, *Nanoscale* 4 (2012) 885.

[2] E. Bortchagovsky, T. Schmid and R. Zenobi, *Appl. Phys. Lett.* 103 (2013) 043111.