

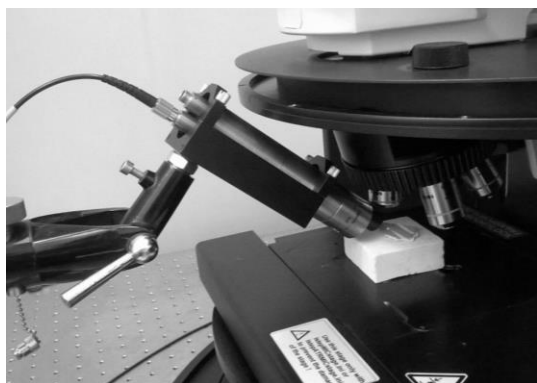
Micro Spatially Offset Raman Spectroscopy for Material Science and Cultural Heritage

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Here we present the results of a recent study in the field of non-invasive analysis of turbid media. The developed technique, micro-scale Spatially Offset Raman Spectroscopy – micro-SORS [1], combines conventional SORS [2] with microscopy concepts and represents a new imaging modality in Raman microscopy. It provides analytical capability for investigating non-invasively the chemical composition of subsurface, micrometer scale-thick diffusely scattering layers at depths more than an order of magnitude larger than those accessible with conventional confocal Raman microscopy. The simplest micro-SORS variant ('Defocusing micro-SORS') is exploitable with conventional Raman microscopes without any modifications, implemented by performing measurements at several 'defocusing' distances by displacing the sample in z-direction from the conventional 'imaged' position. In the most effective variant ('Full micro-SORS') the separation between Raman collection and laser illumination zones on sample surface is employed, requiring adaptations to the configuration of existing Raman microscopes [3]. Potential application areas include non-destructive subsurface analysis of painted layers in Cultural Heritage, characterization of stratified polymer systems, analysis of layered biological samples or forensic analysis. The most significant applications of micro-SORS to Cultural Heritage, food and polymer fields will be presented [4], as well as the latest results acquired in challenging situations including the recovery of sublayer Raman signals in the presence of intensely fluorescing compounds and the non-invasive recovery and 2D reconstruction of overpainted images [5]. Furthermore, the recent development of the first portable full micro-SORS prototype will also be presented enabling the deployment of micro-SORS in the field, an essential feature required for the analysis of many objects of art in museums or at conservation sites [6].



'Full micro-SORS' variant applied to the analysis of a mural painting fragment.

References

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