Metallic substrates, colloidal nanoparticles and fractal structures for surface-enhanced Raman scattering investigation of electronically conducting polymers

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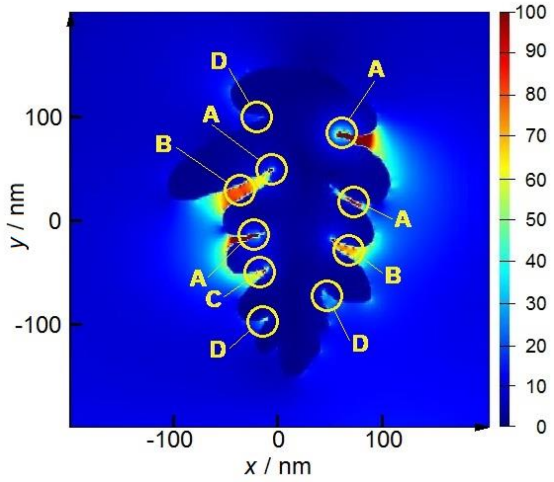
Abstract

Surface-enhanced Raman scattering (SERS), discovered in the mid-1970s, offers remarkable potentialities in analytical chemistry. The adsorption of organic molecules on the surface of metallic nanostructures of gold, silver and less frequently copper, leads to an intensity enhancement of the Raman signal by a factor of up to 10^{14} which would make possible the detection of traces or even single molecule in complex environments such as biological media.

The high sensitivity of this technique is accompanied by a high specificity: the enhancement effect is observed for the part of the chromophore close to the surface even in a complex environment. The advantages of this method, which is easy to implement and very sensitive, have led to numerous applications in fields as varied as analytical chemistry, electrochemistry, biology, nanomaterials, etc.

In complex nanomatrices, the amplification of the local electromagnetic field, due to surface plasmon resonance and responsible for the enhancement effect, arises at intergranular sites, conventionally called “hot spots”, whose dimensions are smaller than the wavelength of the excitation line. Drawing on this, one should expect to observe a huge intensification of the Raman signal for molecules adsorbed or electrodeposited on Ag or Au fractal clusters due to the presence of a large number of “hot spots” in this kind of structures with scale invariance symmetry.

This is the context in which our presentation fits: we will show, in different ways, the power and finesse of SERS and the potentialities it offers in the investigation of electronically conducting polymers thin films. This technique not only allows to provide precise information about the structure of these innovative materials and to follow the *in-situ* changes occurring at the conjugated skeleton during the doping-undoping process, but also to access the spatial arrangement of the chains and their anchoring mode to the SERS-active surface.



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Biography

El Arbi Bazzaoui is currently full professor at Med 1st University (Oujda) where he teaches electrochemistry since 1996, and coordinator of the electrochemistry team of the Materials Chemistry Laboratory. He was granted his PhD in electrochemistry in 1995 at the Institute of Topology and Systems Dynamics (*Denis Diderot* and *Pierre et Marie Curie* Universities - Paris). His research interests are mechanisms of electron transfer in molecular electrochemistry, *in-situ* spectroelectrochemistry, electroanalytical techniques, corrosion, fuel cells, advanced nanomaterials, electronically conducting polymers and SERS. He published more than 60 papers (H-index 23 with 1566 citations https://scholar.google.com/citations?hl=fr&user=zMJO26IAAAAJ). He also has 5 patents in the field of conducting polymers.

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