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Long Photo-Induced Enhanced Raman Scattering (PIERS) in Au nanoparticles embedded in TiO₂

Enhancing Raman scattering is known for more than 40 years now and has been thoroughly investigated. For this a nanostructured metallic substrate is required and it is commonly admitted that this so-called SERS effect can enhance the Raman intensity by a factor greater than 10^6 (depending on the substrate). Recently, it has been shown that it is possible to increase the enhancement even more if the metallic nanostructures are deposited on a semi-conducting surface and exposed to UV radiation prior to the detection [1]. A few tenth of paper have investigated this PIERS effect, however, none of them have succeeded in it making last more than an hour. In this presentation we will show that by co-depositing the Au nanoparticles together with the TiO₂ matrix it is possible to prolongate the duration for at least 8 days. To understand further the specificity of our sample structuration, we have performed cathodoluminescence experiments. The results suggest that the exposition to UV irradiation leads to shorten the width of the Schottky barrier between Au and TiO₂ which is favorable to an enhancement of the chemical effect [2].

References

- [1] S. Ben-Jaber, W. J. Peveler, R. Quesada-Cabrera, E. Cortés, C. Sotelo-Vazquez, N. Abdul-Karim, S. A. Maier, I. P. Parkin, Nat. Commun. 2016, 7, 12189.
- [2] Andrea Brognara, Beatrice R. Bricchi, Ludovic William, Ovidiu Brinza, Maria Konstantakopoulou, Andrea Li Bassi, Matteo Ghidelli, and Nathalie Lidgi-Guigui, Small, 2022

Figures

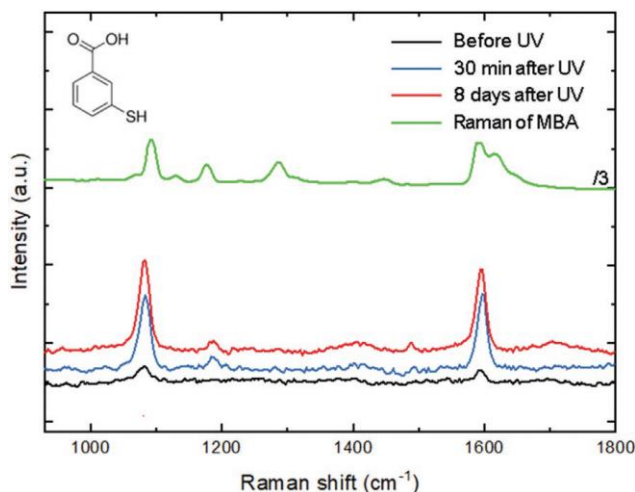


Figure 1: SERS spectra of Mercaptobenzoic Acid on Au nanoparticles embedded in TiO₂ before and after UV irradiation

