

Politecnico di Milano, Department of Energy, Cesnef (Building 19), via Ponzio 34/3, Milan

Friday, May 15<sup>th</sup>, 2020 at 10.00 a.m.

(in teleconference at this link: [Join Microsoft Teams Meeting](#))

## Laser synthesis of plasmonic platforms for SERS-based therapeutic drug monitoring

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Therapeutic Drug Monitoring (TDM) is a clinical practice to selectively determine the concentration of a drug in a biological fluid, usually blood plasma. TDM is critically important for Narrow Therapeutic Index (NTI) drugs, with small differences between therapeutic and toxic doses. Among others, this is true of anti-epileptic drugs (AEDs). For a fraction of AEDs the blood concentration is determined in the lab via immunoassay tests, or High-Performance Liquid Chromatography coupled to Mass Spectrometry (HPLC-MS). Both techniques are time consuming and costly. We focus on the use of light scattering with ad hoc engineered plasmonic substrates as a fast, comparatively inexpensive, complementary TDM approach for AEDs. Noble metal (Au; Ag) nanoparticles (NPs), grown by pulsed laser ablation (PLA) of a high purity target are synthesized along two paths. If ablation is carried out using ns pulses in a high-density inert, massive gas (Ar) NPs form in the expanding plasma plume. If the process is performed with ns, or ps pulses in a transparent liquid (PLAL) a colloidal solution of metal NPs is obtained and is ultrasonically sprayed and let dry on the same kind of inert support (glass, 100-Si) as for gas synthesized NPs. In both cases, self-assembled NP arrays are obtained. The few relevant process parameters that affect the size, size distribution, shape and optical properties of the NPs and the NP arrays are ambient gas pressure and laser pulse number for PLA, as well as pulse duration and laser energy density for PLAL. The ability to adjust the wavelength of the Surface Plasmon Resonance (SPR) peak opens the way to Surface Enhanced Raman Scattering (SERS) measurements of samples of different origin with various AEDs at concentrations of clinical interest using the above sensors. The results of the investigation on the SERS response of a new AED of relevant clinical interest (Perampanel), together with the stringent control of sensor performance are critically discussed.

### References

- [1] C. Zanchi et al., Appl.Phys. A 125, 311 (2019); [2] M. Tommasini et al., Nanomaterials 9, 677 (2019); [3] N.R. Agarwal et al. Appl. Surf. Sci. 466, 19-27 (2019); [4] C. Zanchi et al. Appl.Surf.Sci. 507, 145109 (2020)

### About the speaker:



PMO is with Dipartimento di Energia, Politecnico di Milano.

*Research:* interaction between energetic photons/particles and solid surfaces, nanoparticle synthesis in laser ablation plasmas, design of plasmonic platforms, physico-chemistry of snow, surface treatments for advanced ski bases, snow tribology