Mateis is offering a Post-Doc postion of 11 monthes year in the field of :

Study of the biological behaviour of PVD thin film metallic glasses:

effect of an ultrashort laser treatment

Keywords:

fs Laser Surface Engineering, PVD Thin Film Metallic Glass, Biocompatibility, Microbial activity, Advanced electron and confocal microscopies

Academic structure and context:

The MANUTECH SLEIGHT Graduate School, coordinated by Université de Lyon and managed by Université Jean Monnet in Saint-Etienne, provides an international favourable environment for training and cross-disciplinary research in the domain of Surfaces Light EngineerinG Health and SocieTy (SLEIGHT). Gathering *Laser*, *Surfaces* and *Biology*, the current project addresses two axes of SLEIGHT: Axe 1 devoted to ultrashort laser processing, and Axe 2 linked to the biologic behaviour of advances surfaces.

Metallic glasses represent a recent class of materials with outstanding partially explained properties. Their unexpected behaviours result from their disordered, amorphous atomic structure. Bulk metallic glasses are synthesized under very fast quenching conditions ($10^{5\text{-}6}$K/s). Therefore, only quite small pieces can be got, which limits its transfer at an industrial scale. Another more recent strategy consists in synthesizing these materials under the form of a thin film through an out-of-equilibrium Physical Vapor Deposition process (PVD). As a consequence, must wider chemical ranges can be achieved, opening new investigation fields for Thin Films Metallic Glasses (TFMGs). Among these advanced films, the Zr-Cu system has particularly paid attention to the scientific community for its interesting mechanical and anti-corrosive properties. Besides, it has been shown that a further silver enrichment makes bactericide the surface [1].

Objective of the project is to still extend the multifunctional nature of Zr-Cu based TFMGs, modifying the biocompatibility of the surface on the one hand, and its anti-microbial activity on the other hand. These further properties would result from an ultrashort laser treatment of the TFMG, giving rise to sub-micrometric ripples [2]. Both the local chemistry of the irradiated area and its wettability are affected, which may change the interaction of cells and/or microbes with the surface. The scientific aim of the project is then to better understand the relationships between the laser treatment, the microstructure and physico-chemical properties of the treated surface, and its biological behaviour. Three main laboratories of the Lyon-St Etienne region (France) are involved in the project: Laboratoire Hubert Curien, Laboratoire MATEIS, and Laboratoire SAINBIOSE respectively (see webpages).

Requirements:

The candidates will have a PhD in the field of Materials Science, with a strong background in surface engineering. Candidates with competence (attested by publications) in the field of Laser engineering will be a plus. For this position, it is worth mentioning that experimental interest and skills are required (laser processing, advanced microscopies, biological experiments…). We also wish to hire candidates with a certain international experience (high level in English).

Interested candidates will send a short CV (including list of papers/communications) + motivation letter by e-mail at: philippe.steyer@insa-lyon.fr. Duration of the project: 12 months, kick-off in October 2022, gross salary: about 2750 €/month depending on the past experience.

References :

[1] : S Comby-Dassonneville *et al.*, *ZrCuAg thin-film metallic glasses: toward biostatic durable advanced surfaces*, *ACS Appl. Mater. Interfaces*, **13** (2021) 17062 ; doi.org/10.1021/acsami.1c01127

[2] : M. Prudent *et al.,* High-Density Nanowells Formation in Ultrafast Laser-Irradiated Thin Film Metallic Glass, *Nano-Micro Letters*, **14** (2022) 103 ; doi-org/10.1007/s40820-022-00850-4