Mateis is offering a Post-Doc postion of 1 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 considered first. For this position, it is worth mentioning that experimental interest and skills are required (laser processing, advanced electron and confocal 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