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LASER ABLATION IN ORGANIC PRECURSORS AND ATMOSPHERIC PLASMA POLYMERIZATION: A CONVENIENT COMBINATION FOR SYNTHESIS OF HYBRID ANTIBACTERIAL COATINGS

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Due to the recent progress in the field of medicine and nanobiotechnology, a huge interest has been shown to antibacterial coatings. In this work, we have developed an innovative approach, based on the combination of Liquid Phase - Pulsed Laser Ablation (LP-PLA) and Atmospheric Pressure - Plasma Polymerization (AP-PP), to elaborate antibacterial hybrid thin films constituted of silver nanoparticles (bactericide) and superhydrophobic plasma polymer (bacteriostatic). First, the fabrication of superhydrophobic coatings from plasma copolymerization at atmospheric pressure (AP-PP) of two acrylate precursors has been investigated. Physical and chemical characterizations highlighted changes in surface chemistry and roughness according to the plasma conditions. We have shown that adjusting this ratio allowed to finely control the wetting behaviour and superhydrophobic properties. In a second time, attention was carried on the production of silver nanoparticles (Ag NPs), known for their high and long term bactericidal activity. This has been done by using a promising process consisting on the LP-PLA of a silver metallic target directly immerged in a plasma polymer precursor. The complex mechanisms of Ag NPs production have been elucidated by a correct understanding of the influence of the laser parameters on the plasma plume induced. These findings allow the control of the size, the stability, the surrounding or even the concentration of the Ag NPs colloidal suspension in the organic precursor. Finally, hybrid coatings have been obtained by plasma polymerizing the aforementioned colloidal suspensions. Coatings with different surface wetting regimes have been synthesised with uniform dispersion of Ag NPs. The dispersion and silver release has been quantified and their antibacterial activities against *Staphylococcus epidermidis* have been evaluated. This work highlighted the promising ability of coupling LP-PLA and AP-PP to produce hybrid coatings with antibacterial properties.

Biography

Maxime Delmee has completed his PhD in materials chemistry from collaboration between Luxembourg Institute of Science and Technology and the University of Haute Alsace. He is a Material Scientist specialized in laser synthesis of nanomaterials and atmospheric pressure plasma polymerization for biomedical applications. His research interests are plasma functionalization, plasma polymerization, nanoparticles, additive manufacturing, biomedical applications. He has published several papers in plasma and physical chemistry journals.

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