

Partial Laser Ablation in PVD Multilayers for Multicolored and Nanostructured Surfaces

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The APLM (*Ablation Partielle par Laser dans des Multicouches PVD pour des surfaces Multicolores et nanostructurées in french*) project is supported by the INTERREG VI France–Switzerland 2021–2027 program. The project consortium consists of two universities, namely the Bern University of Applied Sciences (BFH) and the University of Technology of Belfort-Montbéliard (UTBM), as well as four industrial partners (Plasmadium and Gravity for Switzerland, and SILSEF and SAIREM for France).

The objective of APLM is to develop all the technical expertise required to industrialize a process invented and patented by BFH and Plasmadium in May 2024. The invention combines vacuum deposition technologies for ultrathin coatings using PVD and PECVD, together with partial ablation by means of nanosecond, picosecond, and femtosecond pulsed lasers, enabling the generation of cavities within multilayers with nanometric control and precision. Prototypes of multicolored watch dials, as well as molds for nanoimprint lithography (NIL), embossing, and plastic injection molding, will be produced. These prototypes will help promote the technology and enhance the value of the invention, generating economic benefits for all industrial partners of the consortium within the regions and beyond.

The main actions of the project consist in developing various robust processes for depositing brightly colored layers or layers with specific optical properties by combinatorial PVD sputtering, with or without the use of MW-PECVD plasma, while meeting the mechanical specifications required for the targeted applications. Subsequently, a database of laser ablation thresholds (in J/cm²) will be established for the different colored or functional PVD layers produced (20–500 nm thickness range) at different wavelengths. A predictive model will also be designed to estimate the ablation threshold of a material based on its physical properties. Finally, flagship prototypes demonstrating the patented technology will be developed in the fields of multicolored watch dials and nanostructured molds for NIL, embossing, and plastic injection, through the ablation of nanometric cavities structured on three or four levels.

During this poster presentation, a general overview of the project will be provided, along with a presentation of the first colored coatings obtained by BFH and UTBM. These coatings were produced by reactive magnetron sputtering.

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