PRIMA

Advanced Materials Moving Forward

A **SUCCESS** STORY

PLASMA-BASED SURFACE MODIFICATIONS AND NANO-STRUCTURED MULTIFUNCTIONAL COATINGS FOR THE NEXT GENERATION OF BIODEGRADABLE MG-BASED BONE-CONTACT IMPLANTS

Prof. Diego Mantovani of Université Laval partnered with two industrial collaborators: Plasmionique Inc., a Quebec company specializing in the design and construction of custom systems based on plasma, laser, and vacuum technologies for R&D and manufacturing activities, and Biotrics Bioimplants, a German company specializing in the clinical regeneration of human bone and soft tissue. Their goal was to study the impact of different surface modification techniques, including plasma treatment, on magnesium alloys used for bone-contact implants. This project led to the development of a surface process with targeted properties, as well as prototype equipment. It also led to an impact analysis regarding the alloys' microstructure, chemical composition, and corrosion resistance.

The project demonstrated the effectiveness of plasma immersion ion implantation when modifying magnesium-based (Mg) alloys. This advance led to the development of an innovative manufacturing process, resulting in a high-performance coating intended for orthopedic and dental applications.

For Plasmionique, the project offered a strategic opportunity to develop a surface treatment process adapted to magnesium alloys, thus addressing a fundamental need to control the degradation of these materials. This innovation represents significant added value in a context where Mg alloys require specific treatments prior to their integration into biomedical applications. Biotrics Bioimplants, for its part, was able to explore the practical application of plasma treatment on screws made from biodegradable metals. The experiment helped familiarize the company with an emerging technology while assessing its own development potential for new products.

This project helped strengthen the synergy between the Université Laval and Plasmionique teams, thus facilitating the effective resolution of complex problems. The project also led to the acquisition of cross-disciplinary skills involving the functional requirements of next-generation biomaterials and implants, particularly in dentistry and oral health.

This collaboration helped us develop a 3D PVD coating technology for small objects (like medical screws, suture anchors, stents, etc.), but it can also be applied to other objects. We received a significant contribution for the planning and execution stages, as well as the analysis of results. This project led to new marketing opportunities for our systems, and 3D powder coating application in particular, while fostering collaboration with a German SME. PRIMA played an essential role in advancing this project.

\- **Andranik Sarkissian**, CEO, Plasmionique

SECTORS	APPLICATIONS	TRL	DURATION
Health	Dental implant	Start 1, End 6	48 months (2020-2024)

UNIVERSITÉ LAVAL

PLASMIONIQUE

biotrics bioimplants