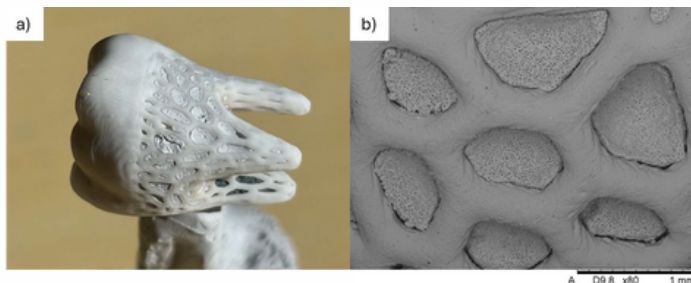




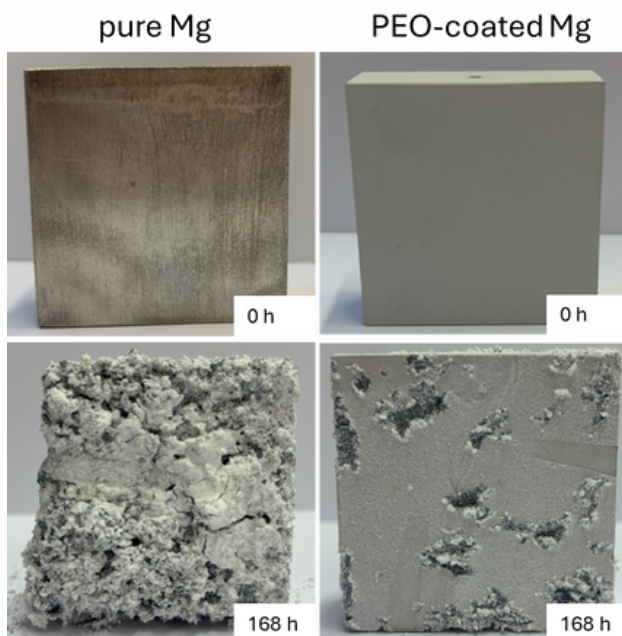
ADDITIVE MANUFACTURING OF CUSTOMIZED CERAMIC DENTAL IMPLANTS SUBSEQUENTLY JOINED WITH BIODEGRADABLE METAL CORES

-NEWSLETTER 4-

Start of the second year of the CERMET project realization launched research on oxide coatings produced on magnesium surfaces by Plasma Electrolytic Oxidation (PEO). During activities in Tasks 3.1 and 3.2, different coatings on magnesium alloys were examined: AZ91, as well as pure magnesium, and Mg-3Zn finally selected for further study. For examination, various samples were considered: pure alloy slabs and ceramic-metal composite structures infiltrated in Tasks 2.2 and 2.3.



A tooth after PEO treatment - macroscopic photograph (a) and SEM picture of coated metal (b)



Pure magnesium sample and one of PEO coated samples before and after exposure to PBS for 168 h

Plasma Electrolytic Oxidation (PEO), known as well as Micro-Arc Oxidation (MAO), is an electrochemical treatment method dedicated mainly to lightweight metal alloys, such as aluminum, titanium, and magnesium. During the process, the metal sample is immersed in the alkaline electrolyte. The current of a certain density runs through the metal and electrolyte to the cathode (usually an element made of stainless steel). Such treatment causes firstly formation of a passive layer on the sample. Then, with increasing thickness of the oxide layer plasma discharges start to occur all over the metal surface. As an effect, porous, oxide coating covers all metal parts of the treated sample.

PEO coatings are successfully applied in medical applications, especially for magnesium implants. The presence of PEO coating can reduce the degradation rate of the implant, allowing it to last longer in designated applications, what can positively affect the healing process. Such applications can be tested in solutions simulating body environment, such as PBS - phosphate-buffered saline. PEO coating application not only slows down the process of implant degradation but positively affects the pH of the environment keeping it closer to neutral value for a longer time, while magnesium dissolving in the human body system results in increasing pH.

Different coating parameters of treatment, as well as different electrolyte compositions were tested and examined during PEO activities realization in the project. Some of the results mentioned here were presented during The 8th International Conference on Magnesium (ICM 8) and The International Conference on Magnesium Alloys and Their Applications (Mg 2024) in the presentation "Elaboration of manufacturing technology of Al₂O₃-Mg alloy composites for customized biodegradable teeth implants" (2-6.11.2024, Chongqing, China).