Summary of Results Obtained So Far

In stage 1 of the project entitled "Innovative coatings through chemical conversion of phosphate to promote osseointegration and biocompatibility of titanium implants", which aims to improve the biological response of Ti implants by depositing phosphate layers on the surface through chemical conversion, the following activities were carried out: A1: Establishing the composition of the phosphating solutions; A2. Establishing the phosphating process; A3. Acquisition and characterization of raw materials; A4. Preliminary obtaining and characterization (OM and SEM) of phosphate layers; A5. Preparation and phosphating of samples; A6. Dissemination, exploitation, and data management.

The results obtained in line with the activities carried out resulted in the following deliverables:

Deliverable 1: Reports/procedures regarding the development of phosphating solutions. To achieve this deliverable, the specialized literature on phosphating solutions for biocompatible materials studied to date was analyzed, and the optimal compositions of the phosphating solutions were established through several experimental trials. Thus, nine recipes for phosphating solutions were established.

Deliverable 2: Report/procedures regarding the stages/parameters of the phosphating technology. To achieve this deliverable, the specialized literature was studied on how the characteristics of the phosphate layers are influenced by the parameters of the phosphating process, as well as the stages of the phosphating technology used in other research. Following these studies and numerous preliminary tests, the stages and parameters of the phosphating process were established.

Deliverable 3: Report on the technical evaluation of basic materials/solutions. To achieve this deliverable, the basic material (Ti6Al4V) was purchased, as were the raw materials used to make the phosphating solutions and other substances used in the phosphating process. All substances were checked against the requirements for their use in obtaining phosphate coatings for biomedical applications. Also, as part of this deliverable, the pH of the phosphating solutions was determined.

Deliverable 4: Technical and scientific report on obtaining phosphate coatings. To achieve this deliverable and identify the optimal phosphate-coating variant using the proposed compositions, nine phosphating solutions were developed. Therefore, three samples were prepared and coated with each layer type according to the established phosphating process steps.

Deliverable 5: Preliminary characterization report. To achieve this deliverable, the samples were preliminarily characterized by optical microscopy and scanning electron microscopy to determine whether the phosphate layer is deposited over the entire surface and whether it is relatively homogeneous.

Deliverable 6: Technical report on sample size and surface preparation parameters. In order to achieve this deliverable, the optimal sample size for each test was analyzed and the number of samples required was determined. At the same time, the parameters for preparing the sample surface were established.

Deliverable 7: Report on sample phosphating. To achieve this deliverable, the Ti6Al4V bars were cut and mechanically prepared. Subsequently, the samples underwent all stages of the established phosphating process. Also, at this stage, due to the limited number of samples that could be coated simultaneously, the phosphating solutions were replenished as needed. At this stage, 360 coated samples were obtained.

The results were disseminated through: Online publication of a brief description of the Pho-Tim project on the project's dedicated website http://www.pho-tim.sim.tuiasi.ro/; publication of preliminary results in a specialist journal: DOI: 10.1016/j.surfin.2025.107884; filing a patent application A/00550 – November 21, 2025: Process for phosphating titanium alloys with a zinc-magnesium-calcium-based solution; participation in an international conference; awarded at two invention salons; holding a workshop on November 12, 2025, which was announced on the websites https://www.aosr.ro/workshop_rossm_2025/ and https://sim.tuiasi.ro/noutati/workshop-rossm-2025/.

In relation to the project implementation plan, all activities with deadlines prior to the submission of this report were successfully completed by the project team.

In conclusion, the project indicators were met by completing all planned activities and achieving the results estimated in the project proposal.

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