In recent years, thanks to the biocorrosion properties of low-alloy zinc alloys containing Mg, Mn, or Sr additives, new applications have appeared. Of particular interest are hypoeutectic Zn-Mg alloys due to their unique corrosion properties. Hence, Zn-Mg alloys have become the preferred candidates for bioresorbable materials for stents and bone implants. The main obstacle to their commercial application has been insufficient mechanical properties. This was due to the brittleness of the materials during cold deformation and the need for elevated-temperature deformation, which caused recrystallization and reduced deformation hardening of the matal.

The aim of this project is to investigate the influence of plastic deformation, by the method of hydrostatic extrusion, on obtaining seamless tubes made of a biocompatible zinc-magnesium alloy, featuring mechanical and corrosion properties suitable for potential use in bioresorbable stents.

In the research conducted so far, only conventional methods of plastic deformation, which required preheating of the material, have been employed. In this respect, the proposed approach to the problem of cold extrusion of seamless tubes at ambient temperature is innovative and unique. The use of the compensating effect of high hydrostatic pressure surrounding the plastically deformed material inhibits the processes of crack generation and propagation during plastic deformation, which becomes particularly important in the case of thin sections of the pipe walls in comparison to volumetric bars.

Thanks to the knowledge of the deformation mechanisms of Zn-Mg alloys, in the complex deformation path by the method of hydrostatic extrusion, it will be possible for the tube to achieve a controlled strengthening of the alloy, obtaining previously unattainable mechanical properties. In the longer term, research carried out by the project will have a particular impact on the development of biomaterials for bioresorbable implants in the form of vascular stents. This would significantly improve implantation procedures, eliminating possible re-intervention in order to remove or replace the implant. The risk of complications related to the possible leaving of the implant in the body would also be reduced. The bioresorbable stent would "dissolve" after fulfilling its role, which would improve the patient's comfort of life and the effectiveness of his treatment.

It is expected that the application of the method of hydrostatic extrusion will allow, in addition to significantly increasing the mechanical properties, to obtain a homogeneous fine-grained structure in the walls of the pipes. The optimization of plastic deformation parameters will be based on the study of mechanical properties and the SEM and TEM electron microscopy methods. In particular, the use of the orientation microscopy technique in TEM and SEM will allow for a quantitative analysis of the microstructure as well as the characteristics and distribution of intergranular and interfacial boundaries, having a significant impact on the mechanical properties and corrosion characteristics of alloys.