

Magnesium and its alloys have long been used for bioabsorbable medical devices, particularly as implants for fractured bones; however, they suffer from poor corrosion resistance, the excessive release of hydrogen and an increase in pH near the implant. The demands for better bioabsorbable medical devices have focused attention on amorphous Mg-based metallic glasses, which have more corrosion resistance and better strength than crystalline Mg alloys. Although they have good strength, their ductility is still the major obstacle limiting their wide application for medical implants.

A breakthrough is expected in the synthesis of hybrid materials, combining metallic-glass precursors in the form of powders and Zn-based crystalline powder as an additional phase. Zn is a bio-absorbable material with an excellent biocompatibility and suitable corrosion rate. In contrast, it suffers from insufficient strength and high creep at 37 °C. There were attempts to produce materials with mixed amorphous/crystalline microstructures and better mechanical properties, especially ductility; however, they used minor additions of Mg-based metallic glasses, containing higher portion of Y, Yb, Cu, Ad, etc., making them unsuitable for medical implants. The project will develop a new, hybrid biodegradable material based on the novel idea of combining Mg-Zn-Ca-(Ag-Sr) metallic glasses with a Zn-based crystalline phase. The resulting materials will give us – in a world first – the mechanical, corrosion and biological performance necessary for truly biodegradable metallic materials that can be used for medical implants. The materials will also be easier to produce, therefore, will be more affordable than their amorphous counterparts, allowing us to have the greatest impact and help as many people as possible with this exciting breakthrough.

To test the hypotheses, the project brings together the expertise of three international partners: Warsaw University of Technology, Poland (WUT), University of Chemistry and Technology, Prague (UCT), Institute of Metals and Technology, Slovenia (IMT), shown graphically in **Fig. 1**.

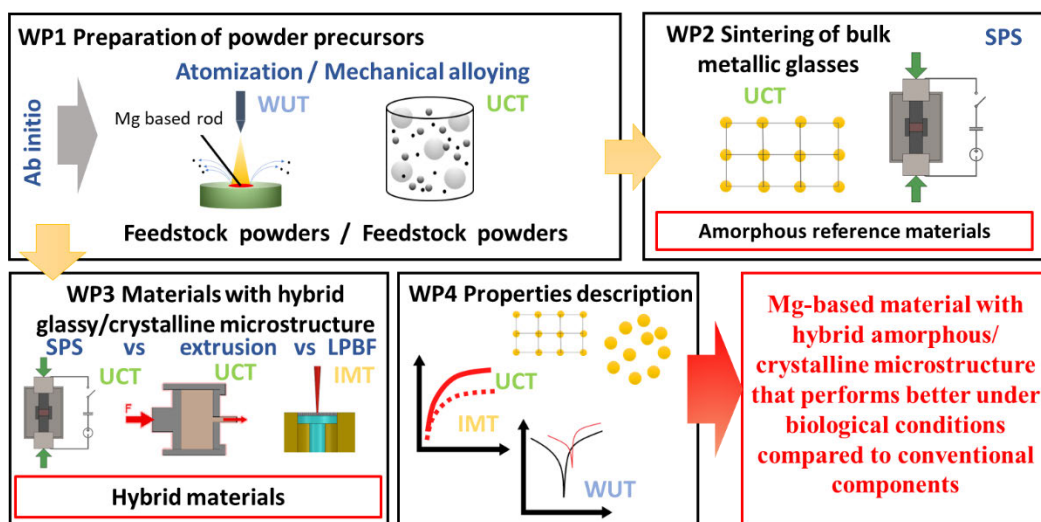


Figure 1. Graphical abstract of the project.

The proposed research project is extremely relevant from the basic research point of view, as it will lead to breakthrough results in better mechanical and corrosion properties by creating a new sort of biodegradable material with a hybrid microstructure composed of a glassy phase of Mg-Zn-Ca-(Ag-Sr) and a crystalline Zn-based phase. The results of the project will enhance our understanding of the complexity of the microstructure-dependent mechanical and corrosion properties of these materials and lead to them exhibiting better performance under biological conditions.