

## Abstract

# Study of the biological activity of laser powder bed fusion Zn-1Mg and Zn-1Mg-1Ag (wt.%) intended for cardiovascular stenting applications

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Nowadays, biodegradable Zn is gaining popularity across diverse applications, including orthopedic scaffolds, wound closure devices, and cardiovascular stents, due to its moderate corrosion rate and biological relevance [1]. However, studies on cell viability and inflammatory responses in human coronary artery endothelial cells (HCAEC), erythrocyte compatibility, and platelet adhesion activity are imperative for evaluating Zn alloys used in laser powder bed fusion (LPBF) manufactured cardiovascular stents. In this study, Zn-1Mg and Zn-1Mg-1Ag (wt.%) cast rods were powdered by ultrasonic atomization in an Ar atmosphere using a rePowder device (AMAZEMET, Poland).

Afterward, LPBF printing was performed using an AconityMIDI (AMAZEMET, Poland) with the following parameters: 75 W of laser power, 420 mm/s of scanning speed, 30  $\mu\text{m}$  of layer thickness, 70  $\mu\text{m}$  of hatch distance, and 75  $\mu\text{m}$  of laser beam size. To assess cytocompatibility, HCAEC supplemented with 5% fetal bovine serum (FBS) were used for the indirect method of testing at a concentration of 10%; additionally, the release of pro-inflammatory cytokine (IL-6) and chemokine (MCP1) was analyzed via ELISA test. In addition, hemocompatibility was studied using blood from a healthy volunteer. The platelet-containing plasma fraction was used for platelet adhesion observations.

Cytocompatibility testing in HCAEC provides insight into how specialized cells respond to Zn alloys, including proinflammatory responses indicating viability at 10% extract concentration, especially on Zn-1Mg-1Ag. However, better results in hemolysis and platelet adhesion were observed for Zn-1Mg. The results suggest that Ag strongly influences the biological response, resulting in higher cellular metabolic activity compared to Zn-1Mg, while slightly compromising blood compatibility.

## AUTHOR'S STATEMENT

Conflict of interest: Authors state no conflict of interest. Informed consent: Informed consent has been obtained from all individuals included in this study. Ethical approval: The research related to human use complies with all the relevant national regulations, institutional policies, and was performed in accordance with the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Acknowledgments: To the National Center of Sciences in Poland, with the grant number 2025/57/N/ST11/02273. To the project Mechanical engineering of biological and bio-inspired systems (MeBioSys), no. CZ.02.01.01/00/22\_008/0004634 funded by the EU. Additionally, the author thanks SECIIHTI (Mexico) for scholarship support for studying abroad.

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