PLA used in 3D printing for medicine application

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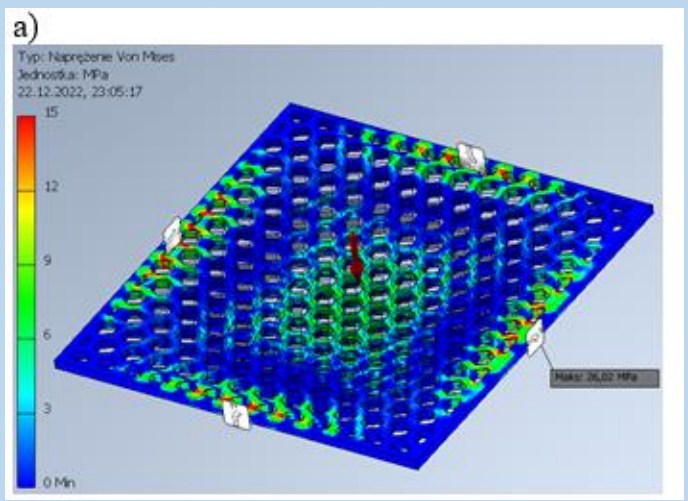
ABSTRACT

This study focusses on determining the best possible structure of the orthosis made with FDM 3D printing technology. To produce the samples, a thermoplastic PLA material was selected that met the conditions of biodegradability, biocompatibility and non-toxicity.
The innovative part of the article are different versions of structures intended for making orthoses used in medicine.

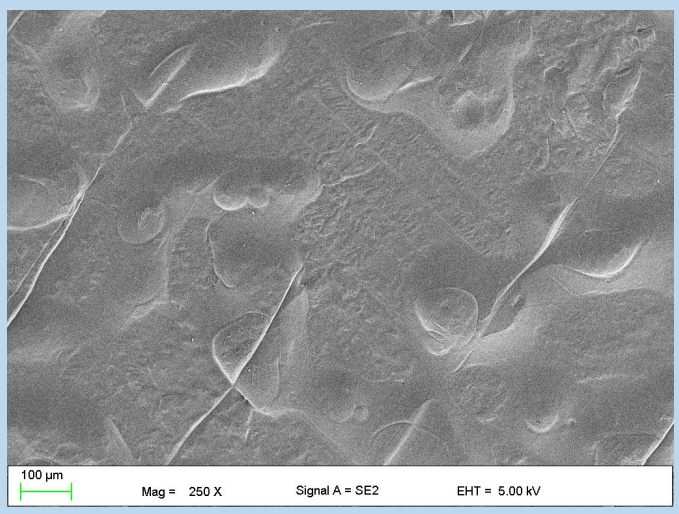
METHODOLOGY

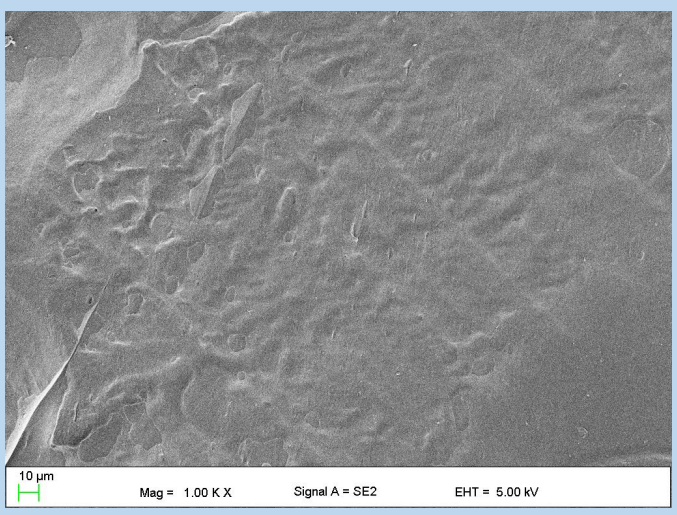
Studies based on FEM analysis were carried out using the advanced engineering software CAE - Inventor. The samples were designed in the CAD system, while the G-Code path was generated using the PrusaSlicer 2.5.0 program dedicated to the Prusa i3 MK3S+ printer, which was used to create the models. Surface morphology observations of PLA were carried out with a Zeiss SUPRA 35 scanning electron microscope (SEM). The static tensile test was performed on the Zwick/Roell z100 device based on the PN-EN ISO 527:1 standard. Electrochemical corrosion tests were carried out using the Autolab PGSTAT302N Multi BA potentiostat in Ringer solution at a temperature of 37 ºC.

RESULTS AND DISCUSSION

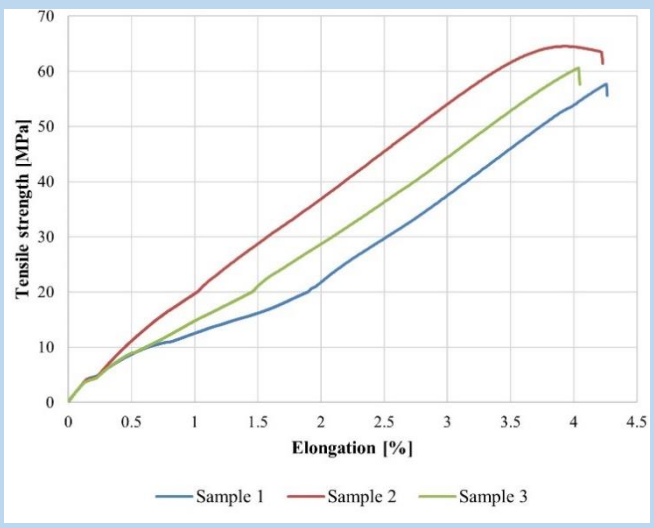


Graphical stress (a) and displacements (b) results for a selected model

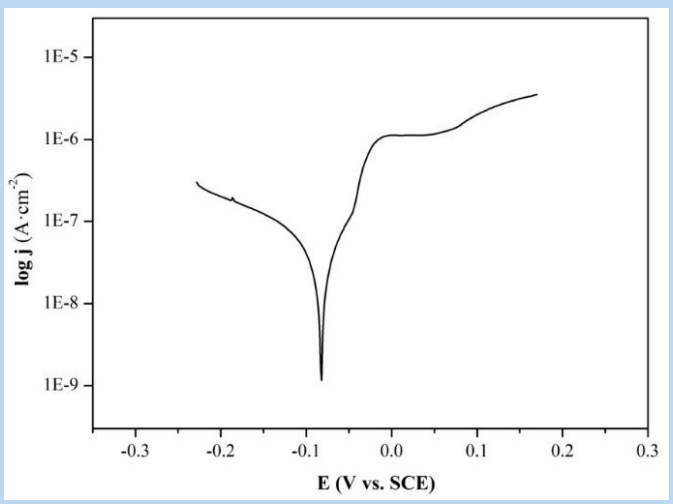




Surface morphology of PLA



Static tensile test results



Polarization curve for the PLA in Ringer solution at 37 °C

Results of static tensile tests

Nr	s_M MPa	e_M %	e_{tM} %	s_B MPa	e_B %	e_{tB} %	b mm	h mm	A_0 mm²
1.	57.7	4.3	4.3	57.7	4.3	4.3	10	2	**20**
2.	64.5	3.9	3.9	64.5	3.9	3.9	10	2	**20**
3.	60.6	4.0	4.0	60.6	4.0	4.0	10	2	**20**
Average values									
-	**61.0**	**4.1**	**4.1**	**61.0**	**4.1**	**4.1**	**10**	**2**	**20**

SUMMARY

The research methodology proposed in the work can be used to study other biomedical materials. The results presented can be the basis for further tests in order to search for the best orthopedic stabilizer.

International Exhibition of Innovation – IEI 2023