# Influence of PCL-nanofibers deposition on biocompatibility and physicochemical properties of titanium alloy

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## Abstract

**Statement of the Problem:** According to data from the Global Burden of Disease Study 2021, the prevalence of musculoskeletal disorders worldwide staggering 123.4% increase from 1990 to 2020, with projections indicating a further 115% rise by 2050. Moreover, there is a pressing need to enhance the functional characteristics of biomaterials to ensure optimal compatibility within the implant–human–body tissue interface. Literature reports indicate failure rates of endoprosthesis reconstructions ranging from 40 to 73% over 5 to 15 years. Among metal biomaterials, Ti6Al4V stands out for its superior biocompatibility, thereby minimizing the risk of adverse reactions within the human body. Titanium-based materials exhibit good corrosion resistance due ability to the spontaneous formation protective oxide layer. While Ti6Al4V is favored in medical applications, it's not without drawbacks. These include potential allergy risks, implant wear issues, poor tribological properties, risks of galvanic corrosion, instability of the protective layer, and challenges with osseointegration due to its bioinert nature.

This study delves into the physicochemical and electrochemical behavior of the Ti6Al4V ELI alloy following lase texturing and PCL deposition via the electrospinning technique. Characterization of the polymer-based layer involved assessments of chemical and phase composition, alongside investigations into surface morphology. The physicochemical properties by contact angle measurements, potentiodynamic test and electrochemical impedance spectroscopy were performed. Cytotoxicity tests were also conducted as part of the study without any referral to address these outstanding issues.

**Conclusion & Significance:** It was found that surface modification by depositing a polymer-based layer on the titanium substrate material using the electrospinning method provides improved corrosion behavior, and the samples exhibit non-toxic properties.

## Image

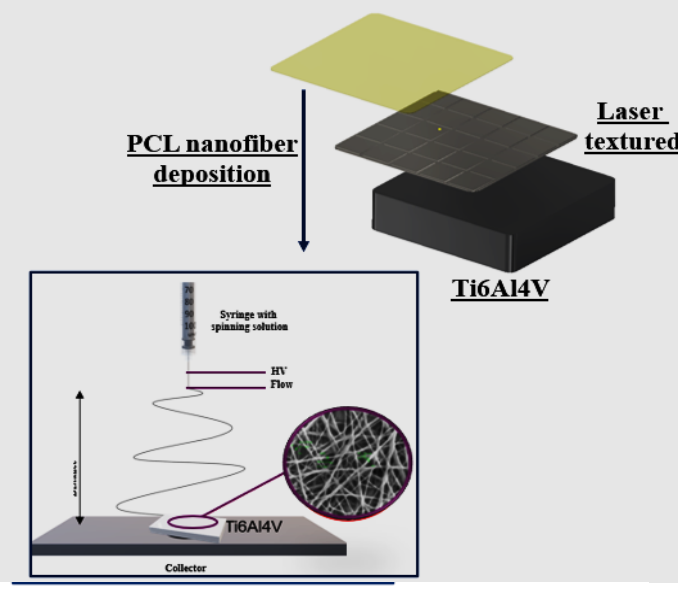


Figure 1. Scheme of surface modification.

## Recent Publications

1. Hamidi, M.F.F.A.; Harun, W.S.W.; Samykano, M.; Ghani, S.A.C.; Ghazalli, Z., Ahmad, F.; Sulong, A.B. (2017) A review of biocompatible metal injection moulding process parameters for biomedical applications. Mater. Sci. Eng. C, 78:1263–1276.
2. Woźniak, A.; Walke, W.; Jakóbik-Kolon, A.; Ziębowicz, B.; Brytan, Z.; Adamiak, M. (2021) The Influence of ZnO Oxide Layer on the Physicochemical Behavior of Ti6Al4V Titanium Alloy. *Materials 1:*230
3. Song, S.; Xiao, G.; Liu, Y.; Zhou, K.; Liu, S.; Huang, J. (2023) Tribological response of groove-textured surface with compressive stress on Ti6Al4V processed by laser and abrasive belt. *Tribol. Int. 180*: 108265.
4. Pallickal Babu, S.; Sam, S.; Joseph, B.; Kalarikkal, N.; E.K., R.; Nair, R.; Thomas, S. (2023) Nanoscale polymer coatings for biomedical implants. *Polym. Nanoscale Mater. Surf. Coatings*,435–457.
5. Ghanbari, A.; Bordbar-Khiabani, A.; Warchomicka, F.; Sommitsch, C.; Yarmand, B.; Zamanian, A. (2023) PEO/Polymer hybrid coatings on magnesium alloy to improve biodegradation and biocompatibility properties. *Surfaces and Interfaces 36*:102495.

Photograph

## Biography

Dr Anna Woźniak is a researcher in the field of biomedical engineering and material science. With a Master of Science in Biomedical Engineering and a Ph.D. in Material Science Engineering, she has dedicated her career to investigating the physicochemical and electrochemical properties of engineering materials, particularly focusing on biocompatible materials and their surface modification. Her work sheds light on advancements in material science for biomedical applications, emphasizing the importance of surface modification techniques in enhancing the biocompatibility and functionality of medical implants and devices

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