Title:
Electro-Discharge Machining of Zr67Cu11Ni10Ti9Be3:An Investigation on Hydroxyapatite Deposition and Surface Roughness

Journal:
Processes, Volume 8, Issue 6, 1 June 2020

Document Type:
Article (Open Access)

Authors:
Aliyu A.A.
Abdul-Rani A.M.
Rubaiee S.
Danish M.
Bryant M.
Hastuty S.
Razak M.A.
alhapis@unikl.edu.my
Ali S.

Full text link:
Publisher : https://www.mdpi.com/2227-9717/8/6/635

Scopus preview
https://www.scopus.com/inward/record.uri?eid=2-s2.0
85087508717&doi=10.3390%2fPR8060635&partnerID=40&md5=2c21bf3ebe97c80b54c37f
62f999ec0b

Citation:
Aliyu, A.A., Abdul-Rani, A.M., Rubaiee, S., Danish, M., Bryant, M., Hastuty, S., Razak, M.A., Ali, S. Electro-discharge machining of Zr67Cu11Ni10Ti9Be3: An investigation on hydroxyapatite deposition and surface roughness (2020) *Processes*, 8 (6), DOI: 10.3390/PR8060635

Abstract:
This study attempts to simultaneously machine and synthesize a biomimetic nanoporous hydroxyapatite coating on the Zr67Cu11Ni10Ti9Be3 bulk metallic glass (BMG) surface. The aim is to investigate and optimize the hydroxyapatite deposition rate and the surface roughness during the electro-discharge coating of Zr67Cu11Ni10Ti9Be3 BMG. Scanning Electron Microscopy (SEM), X-ray powder Diffraction (XRD) and Energy-dispersive X-ray Spectroscopy (EDS) were employed to characterize and analyze the results. Response Surface Methodology using D-optimum custom design approach was utilized to generate the models and optimize the input parameters. A globule nanostructured and nanoporous coating of about 25.2 µm thick, containing mainly Ca, O, and K were ascertained. Further XRD analysis confirmed the deposition of biocompatible oxides (HA, CaZrO3, and ZrO2) and hard ZrC coating on the Zr67Cu11Ni10Ti9Be3 BMG surface. A significant improvement in cell viability was observed in the HA electro-discharge coated BMG specimens. The numerical models for the Hydroxyapatite Deposition Rate (HDR) and Surface Roughness (SR) were developed and experimentally validated using the optimized parameters setting suggested by the software. The achieved average predicted error of 4.94 and 5.09% for the HDR and SR respectively confirmed the excellent reproducibility of the developed models.