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Data Article

Data on the surface morphology of additively manufactured Ti-6Al-4V implants during processing by plasma electrolytic oxidation



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ABSTRACT

Additively manufactured Ti-6Al-4V implants were biofunctionalized using plasma electrolytic oxidation. At various time points during this process scanning electron microscopy imaging was performed to analyze the surface morphology (van Hengel et al., 2017) [1]. This data shows the changes in surface morphology during plasma electrolytic oxidation. Data presented in this article are related to the research article “Selective laser melting porous metallic implants with immobilized silver nanoparticles kill and prevent biofilm formation by methicillin-resistant *Staphylococcus aureus*” (van Hengel et al., 2017) [1].

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Specifications Table

Subject area	Material Science Engineering
More specific subject area	Surface biofunctionalization
Type of data	Microscopy images
How data was acquired	Scanning electron microscope
Data format	Raw
Experimental factors	Ti-6Al-4V implants were fabricated with selective laser melting. Plasma electrolytic oxidation was performed on a custom-made laboratory setup.
Experimental features	Scanning electron microscopy was performed on the surfaces of Ti-6Al-4V implants at various time points during plasma electrolytic oxidation to show the changes in surface morphology.
Data source location	Department of Biomechanical Engineering, Faculty of Mechanical, Maritime, and Materials Engineering, Delft University of Technology (TU Delft)
Data accessibility	Data is within this article

Value of the data

- Data show the changes in surface morphology of additively manufactured Ti-6Al-4V biomaterials during the plasma electrolytic oxidation process.
- The presented data may be used to compare additively manufactured biomaterials with conventionally produced biomaterials after biofunctionalization by plasma electrolytic oxidation.
- Data may be used to compare the effect of plasma electrolytic oxidation treatment with other biofunctionalization techniques on the surface morphology of additively manufactured Ti-6Al-4V biomaterials.

1. Data

Ti-6Al-4V implants were synthesized by selective laser melting and subsequently biofunctionalized using the electrochemical plasma electrolytic oxidation process. Scanning electron microscopy was performed at various time points from 0 to 300 s during plasma electrolytic oxidation and is presented in Figs. 1–3. The provided data are part of the experimental results in previous work by the authors [1].

2. Experimental design, materials and methods

Ti-6Al-4V implants were manufactured using a selective laser melting printer (SLM-125, Realizer, Borchem, Germany). Specimens were produced from medical grade (grade 23, ELI) Ti-6Al-4V powder (AP&C, Boisbriand, Quebec, Canada) with particle size between 10 and 45 μm and spherical particle morphology. Process parameters were 400 W laser source, layer thickness of 50 μm, laser spot size of 145 μm, layer thickness of 50 μm and exposure time of 300 μs. After selective laser melting, loose powder was removed by vacuum cleaning and samples were thoroughly cleaned by ultrasonication in acetone, 96% ethanol and demineralized water for 5 min subsequently.

Samples were biofunctionalized using plasma electrolytic oxidation on a custom-made laboratory setup. Details regarding the experimental setup can be found in [1]. Plasma electrolytic oxidation is an electrochemical process, which drives uniform growth of the titanium oxide (TiO₂) layer on the surface of titanium biomaterials. The electrolyte contained 0.02 M calcium glycerophosphate and 0.15 M calcium acetate. Plasma electrolytic oxidation was performed for 0–300 s under galvanostatic conditions.

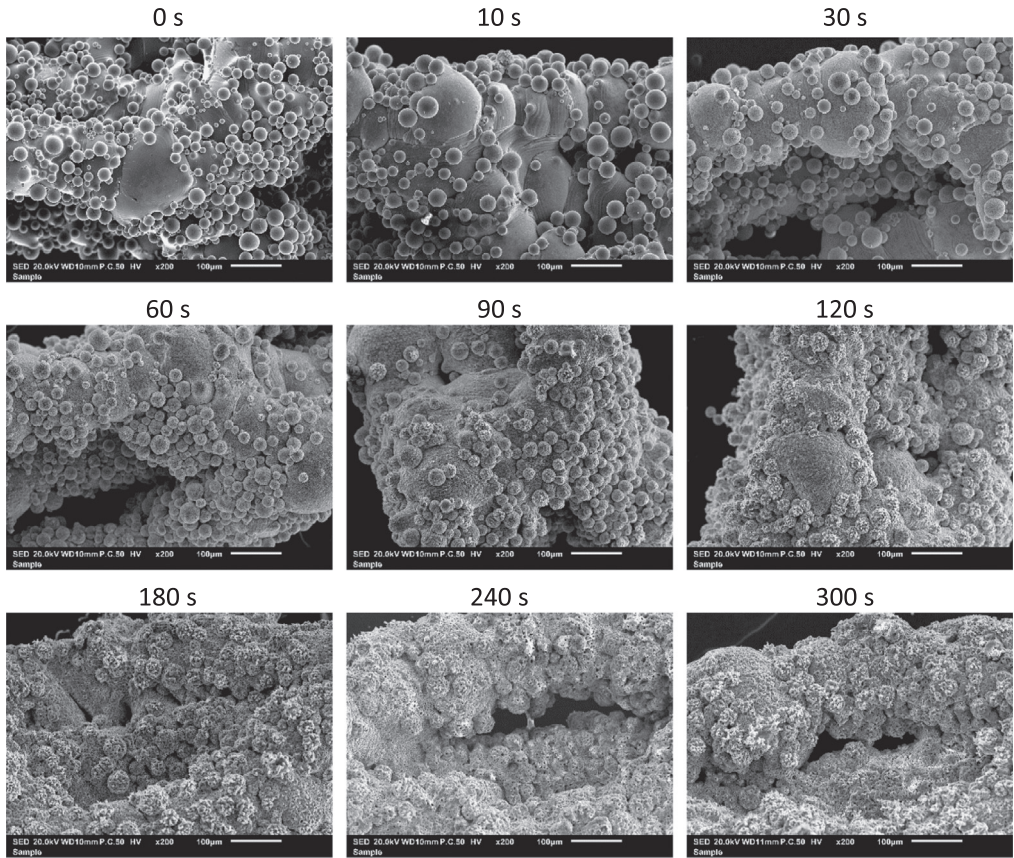


Fig. 1. 200-fold magnification scanning electron microscopy images at different time points of Ti-6Al-4V implants treated with plasma electrolytic oxidation.

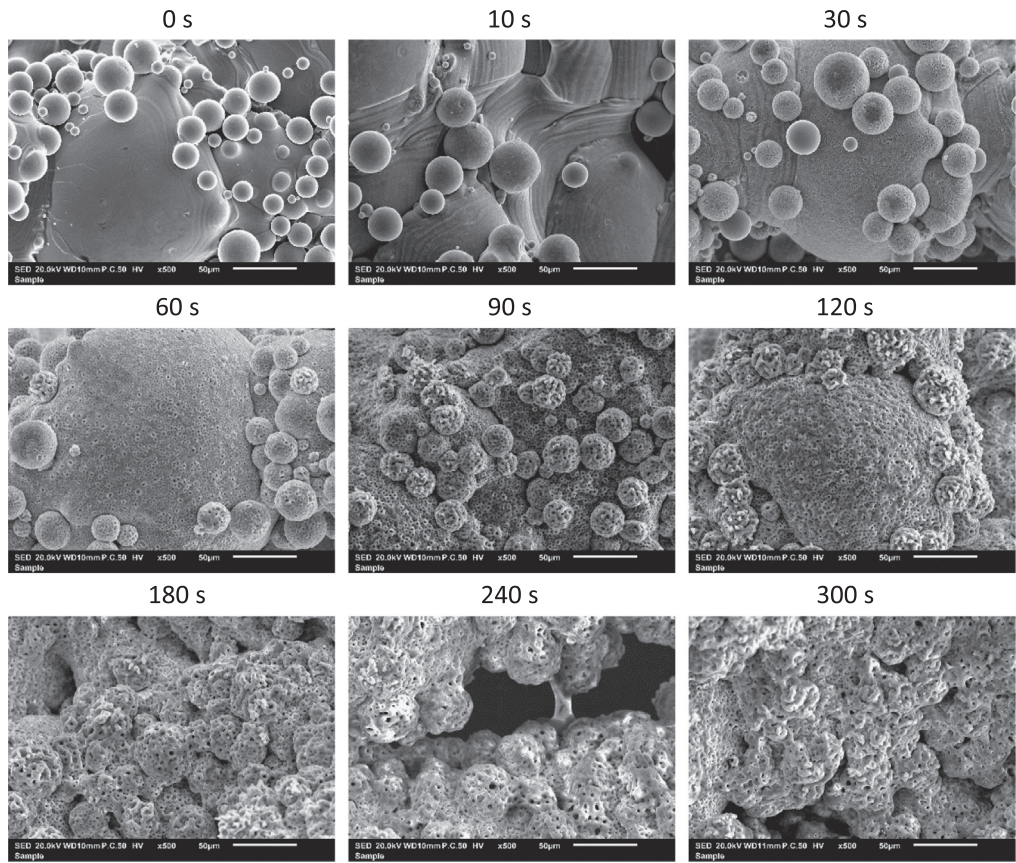


Fig. 2. 500-fold magnification scanning electron microscopy images at different time points of Ti-6Al-4V implants treated with plasma electrolytic oxidation.

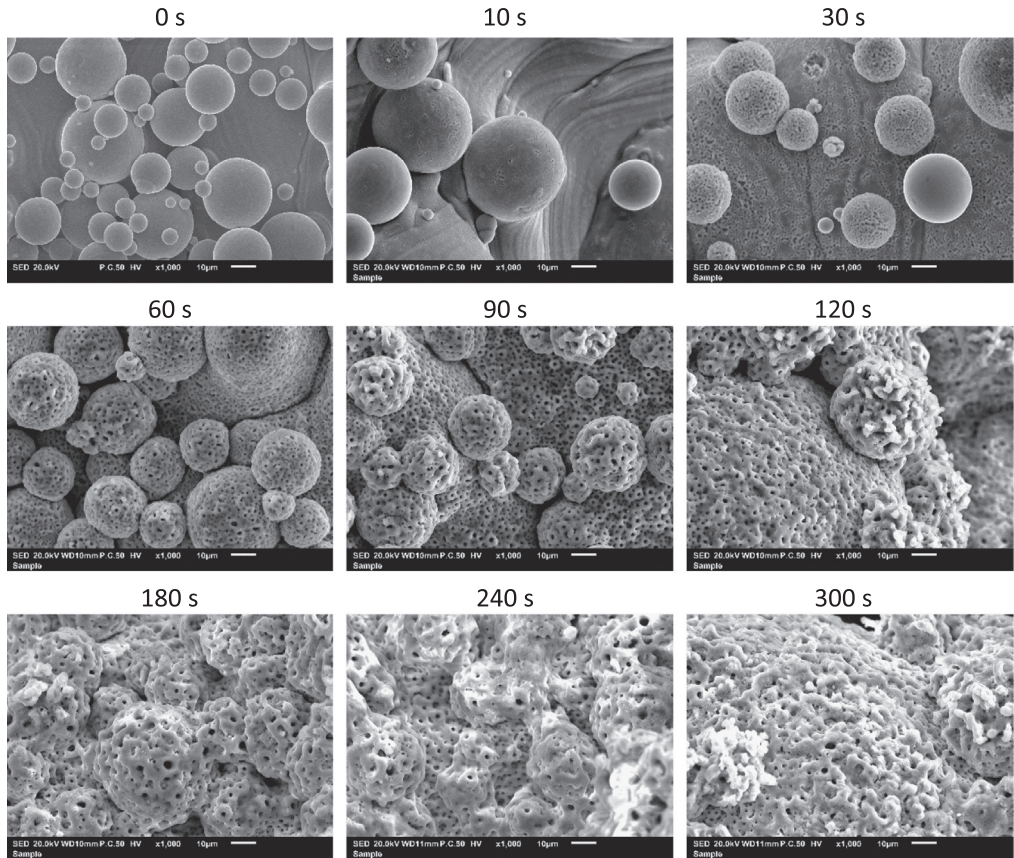


Fig. 3. 1000-fold magnification scanning electron microscopy images at different time points of Ti-6Al-4V implants treated with plasma electrolytic oxidation.

The surface morphology was analyzed by a scanning electron microscope (JSM-IT100LA, JEOL, Tokyo, Japan). Analysis was performed with beam energies between 5 and 20 kV and a 10 mm working distance. Before analysis, specimens were cleaned for 30 s in acetone and 2-propanol subsequently and coated with a gold layer of 5 ± 2 nm. Imaging was performed at 200, 500 and 1000-fold magnifications (Figs. 1–3).

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.dib.2017.06.015>.

Reference

- [1] I.A.J. van Hengel, M. Riool, I.E. Fratila-Apachitei, J. Witte-Bouma, E. Farrell, A.A. Zadpoor, S.A.J. Zaai and I. Apachitei, Selective laser melting porous metallic implants with immobilized silver nanoparticles kill and prevent biofilm formation by methicillin-resistant *Staphylococcus aureus*, *Biomaterials* 140 (2017) 1–15, <http://dx.doi.org/10.1016/j.biomaterials.2017.02.030>.