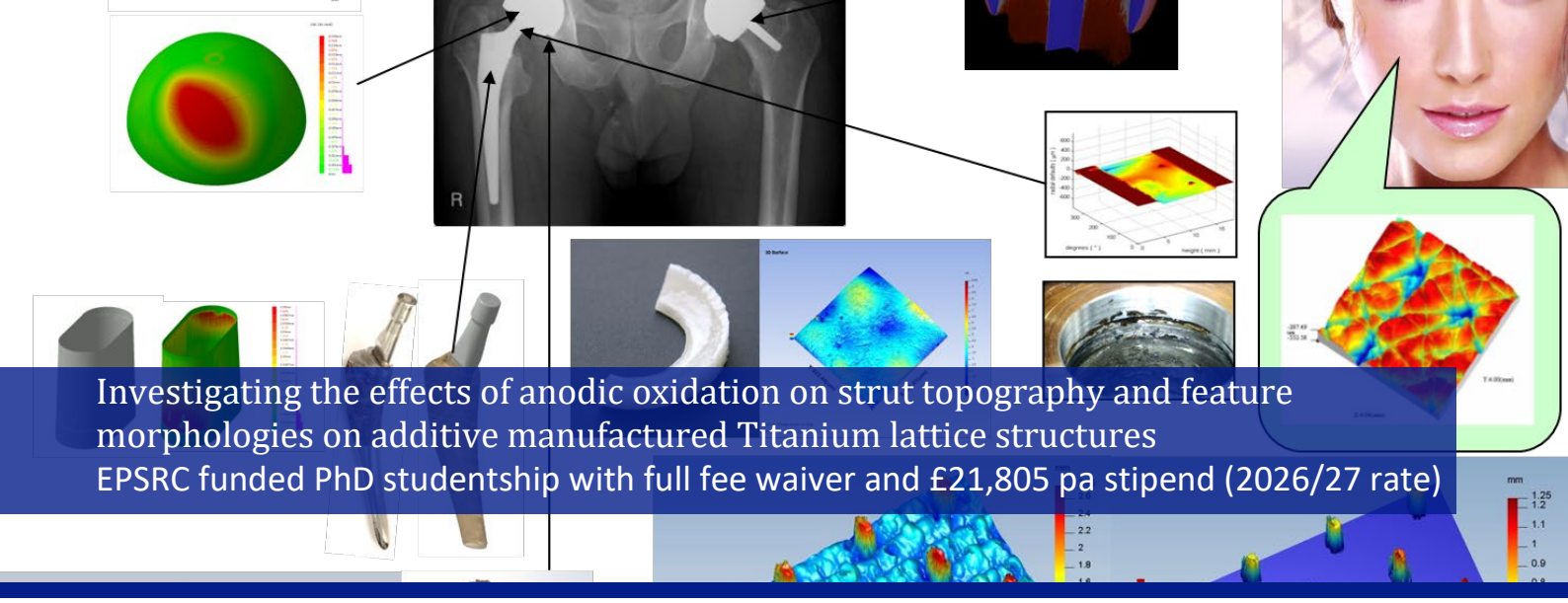


Investigating the effects of anodic oxidation on strut topography and feature morphologies on additive manufactured Titanium lattice structures

EPSRC funded PhD studentship with full fee waiver and £21,805 pa stipend (2026/27 rate)

Project Code: DLA_DTP_2026_12

Main Supervisor: Dr Paul Bills

Co-Supervisor: Dr Chris Jackson

Project Introduction

This project aims to investigate and apply anodic oxidisation techniques, to lattice structures produced through additive manufacturing. Through the control of the anodisation parameters and choice of electrolyte, the aforementioned features will hopefully be produced upon the strut surfaces. Advanced metrological techniques will be applied to characterise and identify these features including interferometric and X-CT approaches. SEM can be utilised for the isolated strut investigations and nanoscale feature identification and characterisation. The distribution, morphology and reproducibility will be investigated. Secondly, the functional implications of these modified surfaces/ structures will be explored, and fields of application will be discussed.

Project Details

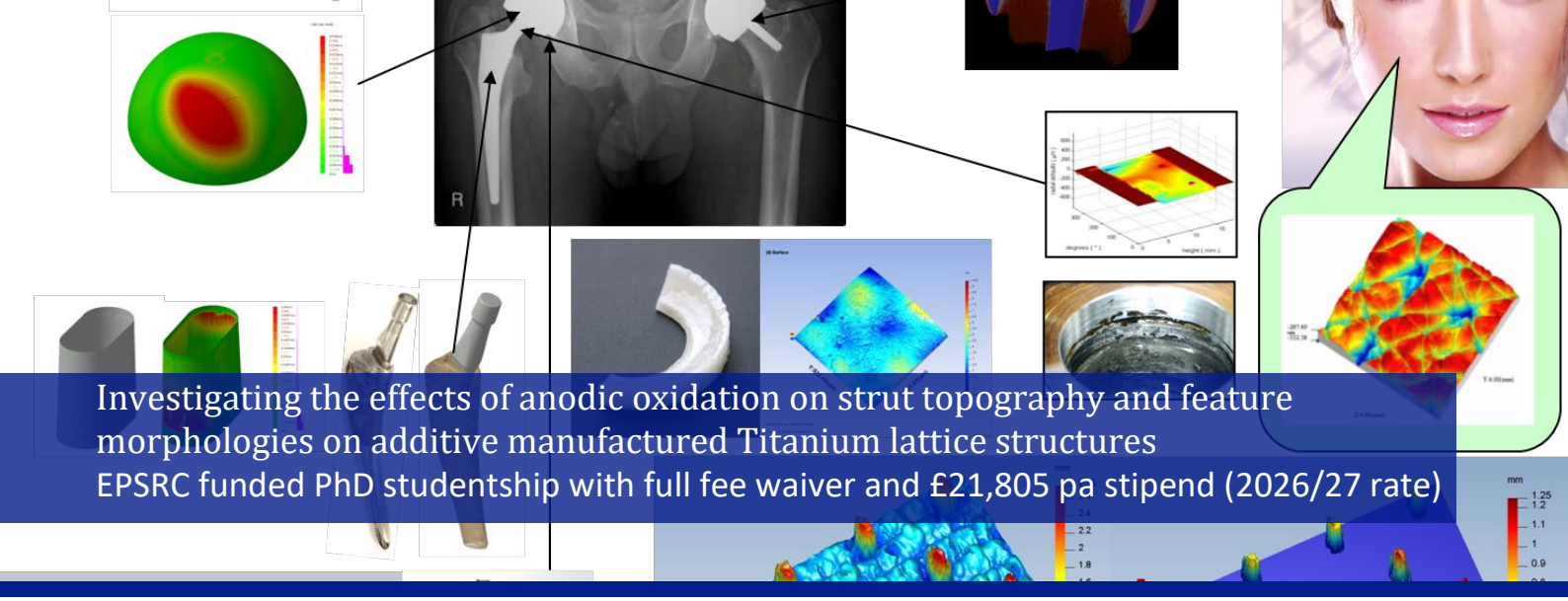
As a means of producing complex and unique lattice structures, Laser Powder Bed Fusion (LPBF) techniques have been utilised with profound success. As the complexity of these structures and resultant components increases, as does the difficulties in post processing. The generalised constituent parts of these structures consist of struts and pores, often produced upon a solid substrate. This results in a complex, unique surface that can be tailored to a given application, through parameter and print optimisation. This optimisation has recently shown success in producing strut diameters sub 100 µm.

The surface finish of additively manufactured surfaces, whilst improving, is historically inferior to those surfaces produced through traditional means such as subtractive machining. Current advances in electrochemical polishing has shown success for complex additive parts, due to its ability to affect the internal geometries of the complex lattice components. The submersive nature of these techniques offer potential possibilities in further modifying these structures, where traditional polishing and finishing approaches are not suitable.

Within multiple fields, the modification of a surface is crucial for a given application and allows for exploration and investigation of new possibilities for that component or its features. Introducing hierarchical features on a topography for instance has shown to impart negative effects on biofilm formation upon a biomaterial surface, for orthopaedic applications. Controlling the surface topography and its features is crucial for tribological applications. These are often done through post processing, either chemically or mechanically. Current questions within academic and industrial research pertain to how the ever-increasing complex additively manufactured surfaces can be processed or treated.

As a means of surface modification, anodic oxidation or anodising of aluminium and titanium has been utilised for decades, often for decorative or identification purposes. As titanium, primarily Ti6Al4V (grade 5) will be used for this project, further discussion of anodisation will refer solely to this. The application of anodic oxidisation of flat or conventional Ti surfaces is well studied, where incorporating these techniques to complex AM lattice structures is seldom studied and novel.

Through the control of the anodisation parameters and choice of electrode/ cathode, micro- and nano-scale features are able to be produced upon surface, thus resulting in a hierarchical topography. These features can either be negative or positive upon a surface, and the choice of electrolyte is the decisive mechanism. If a high fluoride content is present within the electrolyte for example, negative features such as micropores/ pitting and even nanotubes can be formed and the extent of these can be controlled. If a more neutral electrolyte is used, protrusion can develop and the oxide layer is more stable, this technique is utilised to produce the colouring, associated with anodising. Previous studies have applied anodic oxidisation to biomaterial surfaces with high success, these surfaces exhibited decreased bacterial load, and the modified surfaces had significant changes to their topographies.



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Project-specific entry requirements

- 1st class honours degree or Master's degree in Mechanical Engineering, Medical/Biomedical Engineering, Mechatronics, Physics or similar subject.
- Demonstrable knowledge of additive manufacturing/ general manufacturing.
- Demonstrable aptitude in design.

Further Information

This call is open to **UK Applicants only**.

Applicants should be of outstanding quality and exceptionally motivated.

The studentships are funded for 3 years (subject to satisfactory annual performance and progression review) and will provide for tuition fees and a tax-free stipend paid monthly.

Please note that there are more projects than funded studentships available and therefore this is a competitive application process which will include an interview. Shortlisted candidates will be contacted for an interview in person or via Teams. After interview the most outstanding applicants will be offered a studentship.

Queries about the application process are welcome and should be emailed to pgrscholarships@hud.ac.uk.

Informal enquiries about this project should be directed to Dr Paul Bills.

Type of Award: Doctor of Philosophy (PhD).

Eligibility: UK applicants only. First Class or Upper Second-Class Honours degree or equivalent in a relevant subject area, please refer to the entry requirements on the specific projects being advertised.

Location: Huddersfield.

Funding: 3 years full time research covering tuition fees and a tax-free bursary (stipend) starting at £21,805 for 2026/27 and increasing in line with the EPSRC guidelines for the subsequent years. Funded via the Engineering and Physical Sciences Research Council Doctoral Training Programme.

Duration: 3 years full-time plus 12 months writing up (please note that no funding is available for the writing up period).

Closing date: 28th April 2026

Start date: 1st October 2026

Application details

- Go to the EPSRC webpage and download the Expression of Interest Form 2026.
- Provide copies of transcripts and certificates of all relevant academic and/or any professional qualifications.
- Provide references from two individuals – please contact your referees and ask them to send them directly to pgrscholarships@hud.ac.uk from their email address.
- Proof of eligibility – e.g. scan of passport photo page
- Completed forms, including all relevant documents should be submitted via-email to pgrscholarships@hud.ac.uk.

Please note: if you do not attach all the relevant documentation prior to the closing date your application will not be considered.

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