

**PhD Studentship**

Department of Mechanical Engineering

University College London

***STUDENTSHIP TITLE: Understanding phase transformations during additive manufacturing***

**Description:**

Additive manufacturing (AM) is a key enabling technology that produces components with complex shapes directly from digital designs in materials from polymers to aerospace alloys,enabling unprecedented design freedom. Laser AM produces extreme thermal conditions that promises to allow entirely novel materials to be developed. However, our understanding of the impact of the rapid thermal transients created on the phases, microstructures (*e.g.* grains and defects), and residual stress states formed are limited.

This project will use two unique, in-situ/operando AM machines than enable us to see inside the AM process using Diamond’s high energy beamline, I12. This enables ultra-fast (microsecond) real and reciprocal space x-ray imaging of the laser-matter interactions during AM (e.g. see *Nature Communications,* [https://rdcu.be/K6Cz](http://em.rdcu.be/wf/click?upn=lMZy1lernSJ7apc5DgYM8f-2Bx0kti0aDjoTNGd0sCjZM-3D_9NRh7Z-2FFnZvRoomenoFWpSsPufAYiHBqwZkHEnKsLgI6U95-2F5WBW5-2FNwdgC2XmFDj3v5kqY2Y-2FKFWSfFt4n5oH24kkMFh1aFOCQczLpna4BY8cUQy8eTr6AP9TpmIt0b0aDJGeqS3th8j8-2FazqCHhnViYQ7GFD6-2B0w8Z04t-2BZ0raob0Sy4yaj-2FK88xsX4NBOS4j3UUZBh1qeEE8R6LeIgltUv8eqcHqLFuhhUnmuX19FScvGVRbbflF-2FiDM2m1UhjGDPYQkQ9jHtYvrLPaYr9g-3D-3D)). This has resulted in many new insights into AM, including capturing the melting, fluid flow, and solidification behaviour, additionally, the formation of meta-stable phases. This project will build on this success, using these new insights to inform the development of novel alloys that take advantage of the highly non-equilibrium conditions. Two separate alloying approaches will be explored, micron/nano-particulate from grain refinement and the formation of non-equilibrium phases in dual phase (DP) transformation induced plasticity (TRIP) high entropy alloys (HEAs). The experiments will both reveal new phases, and act to inform and validate multi-scale predictive simulations.

The PhD project is jointly supervised by Prof. Peter Lee (UCL) and Dr Robert Atwood (Diamond Light Source), and supported by Dr. Sam Clark.This project will be embedded in the portion of the UK’s hub for Manufacturing with Advanced Powder Processes ([www.mapp.ac.uk](http://www.mapp.ac.uk)) based at Harwell.

**Person Specification:**

Applicants should ideally have a first class undergraduate degree (or equivalent) in Mechanical or Electrical Engineering, Materials, Physics, Mathematics or a related discipline. You should have a keen interest in additive manufacturing, including materials, mechanical properties and process control. Excellent organisational, interpersonal and communication skills, along with a stated interest in interdisciplinary research, are essential.

Ideally you would have experience in a number of the below, learning the others as part of the PhD:

* metallurgy
* additive manufacturing
* programming (for image analysis, open and closed loop control)
* Image analysis
* experimental design
* synchrotron or neutron experiments

**Closing Date and Start Date:**

We will be continuously having informal discussions with interested candidates until this position is filled.

**Value of award:**

Full tuition fees and stipend of up to £18,000 per annum (for 3 years)

**Eligibility:**

The position is open to students on Home Fees. Please do not enquire about this studentship if you are ineligible. Please refer to the following website for eligibility criteria: <https://www.ucl.ac.uk/prospective-students/graduate/research-degrees/mechanical-engineering-mphil-phd>

**Application Process:**

Eligible applicants should first contact Prof Peter Lee, ([peter.lee@ucl.ac.uk](file:///C%3A%5CUsers%5Cm_lele%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CContent.Outlook%5CH3UWOHO4%5Cpeter.lee%40ucl.ac.uk)) quoting the Job reference. Please enclose a cover letter (including the names and contact details of two referees), one-page research statement and two pages CV. The supervisory team will arrange interviews for short-listed candidates. After interview, the successful candidate will be required to formally apply online via the UCL website.

**Contacts:**