



# Taighde Éireann Research Ireland

## **PhD Opportunity: Benchmarking the Mechanical Performance of Additively Manufactured Titanium and Bioresorbable Magnesium Alloy Spinal Cages**

**Institution:** University College Dublin (UCD)

**Centre:** I-Form Research Centre for Advanced Manufacturing

**Supervisors:** Dr. Eoin O'Cearbhaill (Primary Supervisor) with Dr. Mert Celikin & Dr. Fiona Freeman

**Location:** Dublin, Ireland

**Funding:** Fully funded (€25,000 per annum stipend + fees)

**Start Date:** September 2025

---

### **Project Overview**

Are you passionate about medical device innovation, additive manufacturing, and biomechanics? Join I-Form at UCD to undertake a PhD benchmarking the mechanical performance of spinal cage implants fabricated using state-of-the-art additive manufacturing (AM) techniques and next-generation bioresorbable materials.

This project will compare spinal cages produced by Laser Powder Bed Fusion (PBF-LB) of Ti-6Al-4V and a novel low-temperature screw-based material extrusion (SBME) method used to fabricate novel bioresorbable Magnesium (Mg) alloy cages, being developed at UCD. You will explore how processing parameters, microstructure, porosity, and lattice design influence mechanical performance metrics such as compressive strength, fatigue life, and elastic modulus.

Key methodologies include material synthesis, additive manufacturing optimisation, mechanical testing, microstructural characterisation, finite element analysis (FEA), and degradation studies for bioresorbable implants.

This research supports the growing demand for personalised, high-performance, and bioresorbable spinal implants, offering high-impact opportunities for publication, collaboration with industry and clinical partners. Please visit <https://people.ucd.ie/eoin.ocearbhaill> and <https://www.ucd.ie/biomedicalengineering/> to learn more about our activities in medical device innovation.

### **Key Objectives**

- **Design and fabricate** Ti-6Al-4V and Mg alloy spinal cages with tailored lattice structures.
- **Benchmark mechanical properties** (compression, fatigue) across different AM processes.
- **Perform multiscale FEA** validated by experimental tests on synthetic vertebrae.
- **Investigate bioresorbable Mg cages**, focusing on degradation behaviour and mechanical retention.
- **Correlate sensor data, processing parameters, microstructure, and performance** to optimise additive manufacturing processes.



# Taighde Éireann Research Ireland

## Candidate Requirements

- A first-class or high 2.1 degree (or equivalent) in Mechanical Engineering, Materials Science, Biomedical Engineering, or a closely related discipline.
- Experience with medical device development, additive manufacturing, mechanical testing, or finite element analysis is highly desirable.
- Strong analytical skills and an interest in multidisciplinary research.
- Excellent written and verbal communication skills.
- Self-motivated and capable of working independently and in a collaborative research environment.

## Funding and Benefits

- PhD tuition fees covered.
- Stipend: €25,000 per annum (for 4 years).
- Access to world-leading manufacturing, materials, and biomedical research facilities.
- Professional development opportunities through I-Form and UCD doctoral programmes.

## How to Apply

To apply, please send the following to [eoin.ocearbhaill@ucd.ie](mailto:eoin.ocearbhaill@ucd.ie)

- Subject Heading for Email: I-Form PhD Application
- A detailed CV.
- A cover letter outlining your research interests and suitability for the project.
- Academic transcripts.
- Contact details of two academic referees.

**Application Deadline:** 31<sup>st</sup> May 2025

For more information about I-Form, please visit: <https://www.i-form.ie/>