

An Indian-Australian research partnership

**Project Title:** **Micro-mechanisms of plasticity and fracture in alloys produced by additive manufacturing**

**Project Number** **IMURA0721**

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**IITB Department:** Metallurgical Engineering and Materials Science

**Research Clusters:**

**Research Themes:**

Highlight which of the Academy's CLUSTERS this project will address? (Please nominate JUST <b>one</b> . For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a> )		Highlight which of the Academy's Theme(s) this project will address? (Feel free to nominate more than one. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a> )	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
		2	Infrastructure Engineering

**The research problem**

*Define the problem*

As additive manufacturing progresses through the cycle common to most emerging technologies, initial promise is ameliorated by practical considerations. This project will examine the particular challenge of controlling part variability in selective laser melting. Feedstock chemistries and morphology, scanning strategies, sample geometry, and post-processing parameters will affect their mechanical behavior. It is also difficult to control the texture of the component in this process. A comprehensive understanding of the physics and parameters of additive manufacturing/3D metal printing is still lacking. Underperformance of AM manufactured products tells that optimization is still an issue. We will examine processing-structure-property relationships and the effects of the processing parameters on the resultant properties of nickel, titanium, or aluminium alloys using a combination of metallurgical process engineering and micromechanics testing.

**Project aims**

*Define the aims of the project*

To identify key process factors controlling microstructural evolution in additively manufactured alloys and  
To understand the micromechanical response of the complex microstructure developed during additive manufacturing.

**Expected outcomes**

*Highlight the expected outcomes of the project*

We anticipate that the project will advance the understanding of the factors that control part properties in additive manufacturing. Through this research we will be able to develop new recommendations in how powder bed additive manufacturing can be optimised. It will also deliver scientific insight into the micromechanics of textured polycrystals over the several length scales typically encountered in additively manufactured alloys.

**How will the project address the Goals of the above Themes?**

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

The additive manufacturing industry is still young, and one of the key drivers for uptake internationally is qualification of the manufactured parts. We cannot directly address industry capacity and uptake in this project, but this project will build capability that delivers high value add products that are competitive or better than conventionally manufactured parts. For example this research will make significant contributions that can be applied in the fields of biomedical implants and aerospace componentry. In particular it will contribute to the certification and qualification of components for aerospace and biomedical industries.

**Capabilities and Degrees Required**

*List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.*

**Essential**

Degree in Materials Science; Metallurgical Engineering, or Materials Science and Engineering  
Strong understanding of physical metallurgy, and solidification microstructures  
Strong understanding of mechanical properties, including dislocation mechanisms

**Desirable**

Experience in mechanical testing

Experience in scanning electron microscopy

Experience in interpreting welding microstructures

**Potential Collaborators**

*Please visit the IITB website [www.iitb.ac.in](http://www.iitb.ac.in) OR Monash Website [www.monash.edu](http://www.monash.edu) to highlight some potential collaborators that would be best suited for the area of research you are intending to float.*

Select up to **(4)** keywords from the Academy's approved keyword list (**available at [www.iitbmonash.org](http://www.iitbmonash.org)**) relating to this project to make it easier for the students to apply.