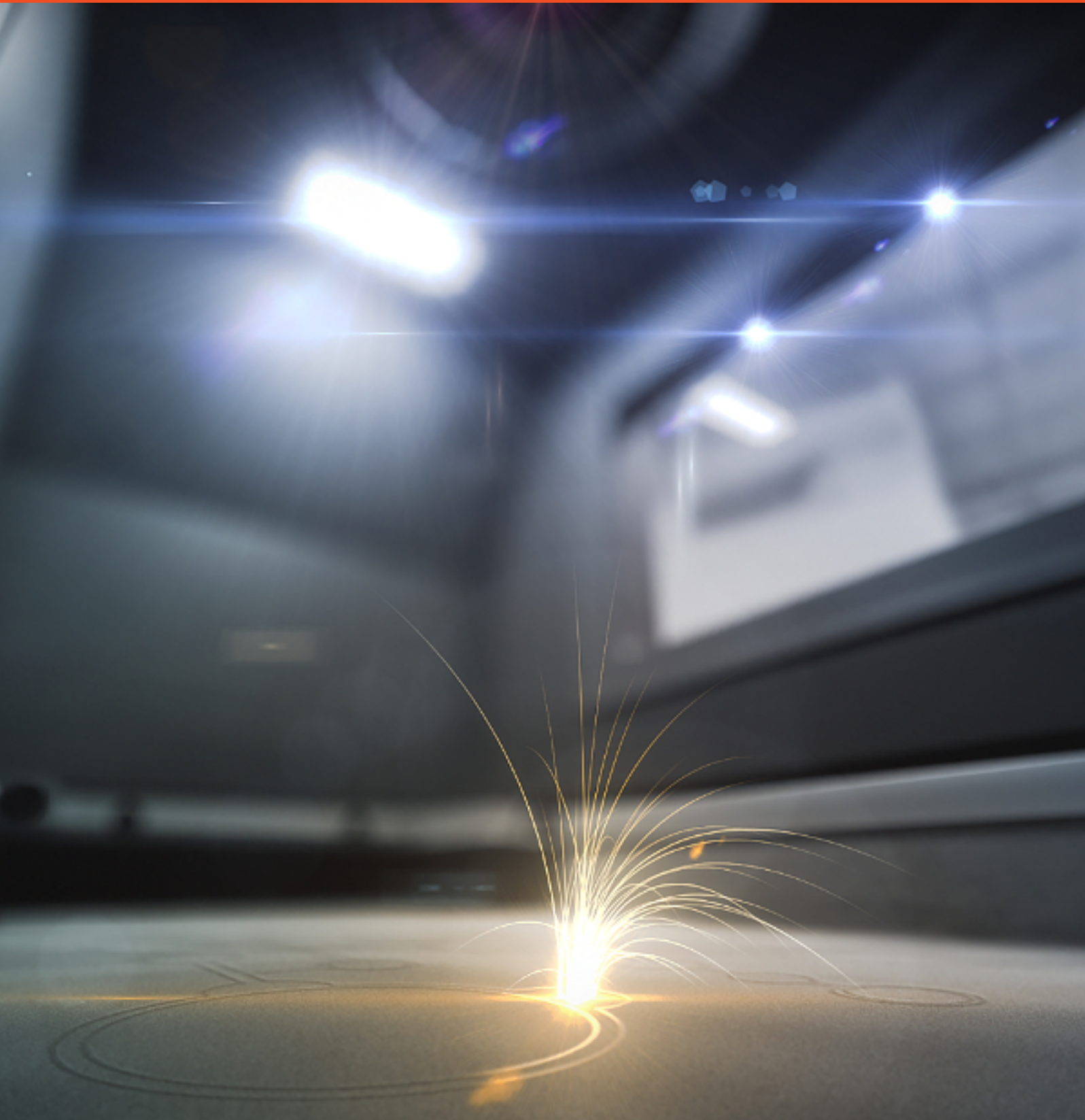


# Sydney Manufacturing Hub



THE UNIVERSITY OF  
SYDNEY

Additive Manufacturing and  
materials processing capabilities  
for researchers and industry



We recognise and pay respect to the Elders and communities – past, present, and emerging – of the lands that the University of Sydney's campuses stand on. For thousands of years they have shared and exchanged knowledges across innumerable generations for the benefit of all.

Cover image: Direct Metal Laser Melting (DMLM) of aluminium inside the Concept Laser M2 Dual Laser. Credit: GE

# Sydney Manufacturing Hub

## *A Core Research Facility at the University of Sydney*

We specialise in cutting-edge Additive Manufacturing (AM) and materials processing, and offer access to researchers and industry.

Our constantly evolving suite of latest-generation technologies enables high-resolution 3D printing in metal, ceramic, and polymer-based materials.

We also offer design and technical expertise, characterisation, and extensive pre- and post-processing capabilities.

Our unique research-focused manufacturing facility enables concept-to-production capabilities in the areas of health, transport, aerospace, defence, and construction.







# Metal AM capabilities

## LASER BEAM

Direct Metal Laser Melting (DMLM) is a Powder Bed Fusion (PBF) process that utilises a laser beam to melt and fuse metal powders. It supports a range of materials and offers high printing accuracy and excellent part chemistry. After printing, parts need to be heat treated to relieve residual stresses.

### Concept Laser Mlab 200R

The Concept Laser Mlab 200R is typically used in research environments.

|                  |                                  |
|------------------|----------------------------------|
| Build Volume:    | 100 x 100 x 100h mm <sup>3</sup> |
| Laser System:    | 200 W fibre laser                |
| Layer Thickness: | 15 – 30 µm *material dependent   |

### Concept Laser M2 Dual Laser

The Concept Laser M2 Dual Laser utilises two lasers for increased printing speed compared with the Mlab 200R. It is widely used in aerospace, automotive, and medical device industries for the production of functional prototypes and end-use parts.

|                  |                                  |
|------------------|----------------------------------|
| Build Volume:    | 245 x 245 x 320h mm <sup>3</sup> |
| Laser System:    | 2 x 400 W fibre laser            |
| Layer Thickness: | 20 – 80 µm *material dependent   |

## ELECTRON BEAM

Electron Beam Melting (EBM) is a Powder Bed Fusion (PBF) process that utilises an electron beam to melt and fuse metal powders. The build chamber is a heated vacuum environment, so after printing, parts do not need to be stress relieved. EBM machines are widely used in aerospace, defence, and medical device industries for the production of complex and critical parts.

### Arcam A2X

|                            |                                  |
|----------------------------|----------------------------------|
| Build Volume:              | 200 x 200 x 380h mm <sup>3</sup> |
| Electron Beam System:      | 3 kW                             |
| Build Chamber Temperature: | 600 – 1,100°C                    |
| Layer Thickness:           | 20 – 100 µm *material dependent  |

### Arcam Spectra H

|                            |                                 |
|----------------------------|---------------------------------|
| Build Volume:              | Ø250 x 430h mm <sup>3</sup>     |
| Electron Beam System:      | 6 kW                            |
| Build Chamber Temperature: | 600 – 1,100°C                   |
| Layer Thickness:           | 20 – 100 µm *material dependent |

# Ceramic AM capabilities

## Lithoz CeraFab 7500

The Lithoz CeraFab 7500 is a high-precision digital ceramic 3D printer. It has a wide range of applications including biomedical implants, opto-electronics, and in high-tech industries for the production of parts with exceptional accuracy, strength, and surface finish.

|                     |   |
|---------------------|---|
| Technology:         | Vat Photopolymerisation – Digital Light Processing (DLP)  |
| Build Volume:       | 76 x 43 x 170h mm <sup>3</sup>  |
| Number of Pixels:   | 1,920 x 1,080 (Full HD)   |
| Lateral Resolution: | 40 µm   |
| Layer Thickness:    | 10 – 100 µm *material dependent   |
| Build Speed:        | Up to 100 slices per hour   |
| Available Slurries: | Aluminium Nitride<br>Zirconia-toughened Alumina (LithaLox ZTA 1080)<br>Alumina-toughened Zirconia (LithaCon ATZ 980)<br>Alumina (LithaLox 350, LithaLox 360, LithaLox HP 500)<br>Zirconia (LithaCon 3Y 210, LithaCon 3Y 230)<br>Silica-based (LithaCore 450)<br>Silicon Nitride (LithaNit 782)<br>Tricalcium Phosphate (LithaBone TCP 300)<br>Hydroxy Apatite (LithaBone HA 480)<br>Quartz Glass (LithaGlass) – transparent<br>Lithium Disilicate |

## DeltaWASP 40100 Clay

The DeltaWASP 40100 Clay is a large format ceramic 3D printer. It is accurate and reliable, and is used for prototyping and small-scale manufacturing of clay, concrete, earthenware, porcelain, and refractory materials.

|                  |                                   |
|------------------|-----------------------------------|
| Technology:      | Liquid Deposition Modelling (LDM) |
| Build Volume:    | Ø400 x 1,000h mm <sup>3</sup>     |
| Layer Thickness: | 0.5 mm minimum                    |
| Build Speed:     | Up to 150 mm per minute           |





# Polymer AM capabilities

## Phrozen Sonic Mega 8K

The Phrozen Sonic Mega 8K is an ultra-high resolution LCD resin 3D printer. With an 8K LCD resulting in 43 µm lateral resolution, it is useful when a very high level of detail is required for large parts.

|                            |                                  |
|----------------------------|----------------------------------|
| <b>Technology:</b>         | Vat Photopolymerisation          |
| <b>Build Volume:</b>       | 330 x 185 x 400h mm <sup>3</sup> |
| <b>Light Source:</b>       | 405 nm ParaLED Matrix 3.0        |
| <b>Number of Pixels:</b>   | 7,680 x 4,320 (8K)               |
| <b>Lateral Resolution:</b> | 43 µm                            |
| <b>Layer Thickness:</b>    | 10 – 300 µm                      |
| <b>Build Speed:</b>        | Up to 70 mm per hour             |

## Phrozen Sonic Mini 8K

The Phrozen Sonic Mini 8K is an ultra-high resolution LCD resin 3D printer. With an 8K LCD resulting in 22 µm lateral resolution, it is useful when a very high level of detail is required for intricate parts.

|                            |                                 |
|----------------------------|---------------------------------|
| <b>Technology:</b>         | Vat Photopolymerisation         |
| <b>Build Volume:</b>       | 165 x 72 x 180h mm <sup>3</sup> |
| <b>Light Source:</b>       | Linear Projection LED Module    |
| <b>Number of Pixels:</b>   | 7,680 x 4,320 (8K)              |
| <b>Lateral Resolution:</b> | 22 µm                           |
| <b>Layer Thickness:</b>    | 10 – 300 µm                     |
| <b>Build Speed:</b>        | Up to 80 mm per hour            |

## BMF microArch S240

The BMF microArch S240 is an ultra-high resolution UV-LED 3D printer, suitable for both resins and ceramics. With 10 µm lateral resolution, it has a wide range of applications including microfluidics, micro-electromechanical systems, biotech, pharma, and electronics, for the production of functional prototypes and end-use parts.

|                            |   |
|----------------------------|---|
| <b>Technology:</b>         | Vat Photopolymerisation                       |
| <b>Build Volume:</b>       | 100 x 100 x 75h mm <sup>3</sup>               |
| <b>Light Source:</b>       | 405 nm UV-LED                                 |
| <b>Lateral Resolution:</b> | 10 µm   |
| <b>Layer Thickness:</b>    | 10 – 40 µm                                    |
| <b>Surface Finish:</b>     | 0.4 – 0.8 µm Ra (top), 1.5 – 2.5 µm Ra (side) |

## Formlabs Form 3B

The Formlabs Form 3B is optimised for biocompatible resins. It uses a system of lenses and mirrors to achieve accurate and reliable parts, with high detail and smooth surface finish.

|                            |                                   |
|----------------------------|-----------------------------------|
| <b>Technology:</b>         | Vat Photopolymerisation           |
| <b>Build Volume:</b>       | 145 x 145 x 185h mm <sup>3</sup>  |
| <b>Light Source:</b>       | 250 mW laser with 85 µm spot size |
| <b>Lateral Resolution:</b> | 25 µm                             |
| <b>Layer Thickness:</b>    | 25 – 300 µm                       |



## AON M2+

The AON M2+ is a high temperature filament 3D printer for the production of strong, high-performance parts with high crystallinity and reduced porosity in materials such as PEEK, PEKK, and ULTEM. It is equipped with independent dual extruders, and process controls such as water-cooled hot ends and an actively heated build chamber.

|                            |                                     |
|----------------------------|-------------------------------------|
| Technology:                | Fused Filament Fabrication (FFF)    |
| Filament Size:             | Ø1.75 mm on dual extruders          |
| Build Volume:              | 450 x 450 x 565h mm <sup>3</sup>    |
| Hot End Temperature:       | Up to 500°C                         |
| Build Plate Temperature:   | Up to 220°C                         |
| Build Chamber Temperature: | Up to 135°C                         |
| Positional Accuracy:       | 25 µm (horizontal), 1 µm (vertical) |
| Layer Thickness:           | 50 – 500 µm                         |

## Intamsys Funmat HT

The Intamsys Funmat HT is a high temperature filament 3D printer for the production of strong, high-performance parts in materials such as PEEK, PEKK, and ULTEM.

|                            |                                  |
|----------------------------|----------------------------------|
| Technology:                | Fused Filament Fabrication (FFF) |
| Filament Size:             | Ø1.75 mm                         |
| Build Volume:              | 260 x 260 x 260h mm <sup>3</sup> |
| Hot End Temperature:       | Up to 450°C                      |
| Build Plate Temperature:   | Up to 160°C                      |
| Build Chamber Temperature: | Up to 90°C                       |
| Positional Accuracy:       | 12.5 µm                          |
| Layer Thickness:           | 50 – 300 µm                      |

## 3D Platform 200 Series Workbench Classic

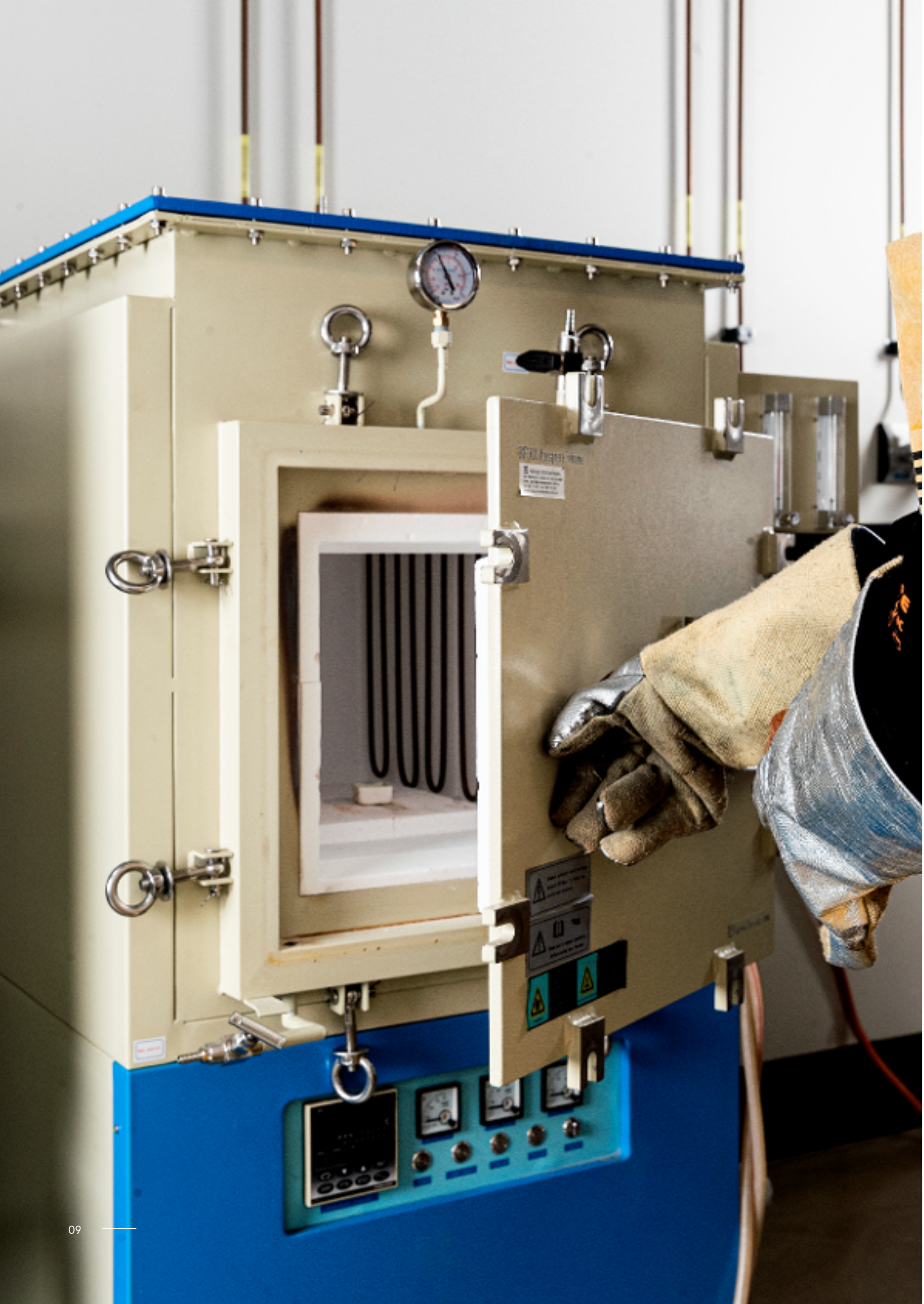
The 3D Platform 200 Series Workbench Classic is a large format filament 3D printer, capable of handling significantly larger parts than standard desktop 3D printers. It has a durable construction to meet the demands of industrial applications.

|                          |                                      |
|--------------------------|--------------------------------------|
| Technology:              | Fused Filament Fabrication (FFF)     |
| Filament Size:           | Ø1.75 and Ø2.85 mm on dual extruders |
| Build Volume:            | 1,000 x 1,000 x 500h mm <sup>3</sup> |
| Hot End Temperature:     | Up to 295°C                          |
| Build Plate Temperature: | Up to 145°C                          |
| Layer Thickness:         | 50 – 350 µm                          |

## Prusa i3 MK3S

The Prusa i3 MK3S is a desktop filament 3D printer. It is typically used for small jobs and the production of prototype parts.

|                          |                                  |
|--------------------------|----------------------------------|
| Technology:              | Fused Filament Fabrication (FFF) |
| Filament Size:           | Ø1.75 mm                         |
| Build Volume:            | 250 x 210 x 210h mm <sup>3</sup> |
| Hot End Temperature:     | Up to 300°C                      |
| Build Plate Temperature: | Up to 120°C                      |
| Layer Thickness:         | 50 – 350 µm                      |



# Heat treatment capabilities

## FURNACES

### Nabertherm VHT 45/15-MO

Controlled atmosphere  
High temperature cold wall retort furnace  
Temperature: Up to 1,450°C  
45 L – 300 x 300 x 500h mm<sup>3</sup>  
Argon, Nitrogen, or vacuum environment

### Nabertherm VHT 08/18-W

High temperature cold wall retort furnace  
For the debinding and sintering of ceramics  
Temperature: Up to 1,800°C  
8 L – 170 x 240 x 200h mm<sup>3</sup>  
Argon, Nitrogen, or vacuum environment

### Nabertherm LHTCT 08/16

For the debinding and sintering of ceramics  
Temperature: Up to 1,600°C  
8 L – 170 x 290 x 170h mm<sup>3</sup>

### Nabertherm LH 60/14

Temperature: Up to 1,400°C  
60 L – 400 x 400 x 400h mm<sup>3</sup>  
Air, Argon, or Nitrogen environment

### Across International GCF 1700

Controlled atmosphere  
Temperature: Up to 1,700°C  
35 L – 400 x 300 x 300h mm<sup>3</sup>  
Argon, Nitrogen, or vacuum environment

## OVENS

### Nabertherm TR30 drying oven

Temperature: RT to 300°C  
30 L – 360 x 300 x 300h mm<sup>3</sup>

### Nabertherm TR60 drying oven

Temperature: RT to 300°C  
60 L – 450 x 390 x 350h mm<sup>3</sup>

## BATHS

### Oil baths

Temperature: 80°C to 260°C  
Size: 500 x 300 x 200h mm<sup>3</sup>

### Salt baths

Temperature: 400°C to 1,050°C  
Size: Ø200 x 400h mm<sup>3</sup> and Ø100 x 250h mm<sup>3</sup>



# Melting and alloying capabilities

## Edmund Buhler AM 500 arc melter

The arc melter is used for melting metals, typically to form an alloy. Metals are placed in the water-cooled copper crucible mould, then heat is generated by an electric arc struck between the tungsten electrode and the metals, melting the metals to form a button or rod sample. Repeated melting is performed to improve the homogeneity of the alloy. The Edmund Buhler AM 500 arc melter is used for melting metals up to 500 g at temperatures up to 3,500°C.

## Indutherm VTC 200 V tilt casting machine

The tilt casting machine provides reliable and efficient melting and casting of a wide range of metals. It uses induction heating for melting the metals, which are then poured into a mould to form the desired shape. The Indutherm VTC 200 V tilt casting machine is used for melting metals at temperatures up to 2,100°C, with a volume of 145 cm<sup>3</sup> in the graphite crucible and 180 cm<sup>3</sup> in the ceramic crucible.

# Pre-processing capabilities

## Noztek fusionX extruder

The Noztek fusionX is a single screw hot melt extruder used for exotic material manufacturing. It has interchangeable blending blades to help refine the mixing process, three independent temperature sensors, and the ability to connect to a computer for accurate real-time monitoring. It has a maximum temperature of 450°C.

## Noztek Pro extruder

The Noztek Pro extruder is used for manufacturing custom filament from pellets as either pure polymer or blended polymer mixtures. It has a maximum temperature of 300°C, Ø1.75 and Ø2.85 mm dies, and is capable of extruding 2.5 m per minute.

# Post-processing capabilities

## Makino U6 H.E.A.T. Electrical Discharge Machine

The Electrical Discharge Machine (EDM) uses a controlled electrical discharge to perform non-contact, high precision machining of a workpiece immersed in dielectric fluid by a wire electrode. The table size is 910 x 710 mm<sup>2</sup>, the maximum machining size is 650 x 450 x 400h mm<sup>3</sup>, the U-axis is ± 75 mm and the V-axis is ± 75 mm. The range of wire electrode used is Ø0.05 – Ø0.40 mm.

## Blasting cabinets

Sydney Manufacturing Hub has two blasting cabinets, one with glass beads and the other with garnet media, for the surface finishing of parts.

## Ceramic mass-finisher

The ceramic mass-finisher is a vibratory machine for the surface finishing of parts, it has three grades of aggregate – coarse, medium, and fine.

## Lapidary tumbler

The lapidary tumbler is a rotary machine for the surface finishing of parts, it tumbles the parts in an aggregate of the same material (usually supports from printing the parts that have been removed).



# Characterisation tools

## LPW POWDERFLOW KIT

The LPW POWDERFLOW KIT is a comprehensive powder flow measurement kit, allowing users to quickly and fully characterise powder flow to known ASTM standards. It is used to determine Hall Flow (ASTM B213) and Carney Flow (ASTM B964), and to derive Carr Index and Hausner Ratio.

## Granutools GranuDrum

The Granutools GranuDrum is used to measure the dynamic flow properties of powder. It operates by rotating a drum filled with a powder sample and taking snapshots at varying rotating speeds. Software then analyses the images to determine properties such as flowability, cohesion, thixotropy (agglomeration, segregation, and attrition), caking, and aeration.

## Struers LaboPol-30 grinder polisher

The Struers LaboPol-30 is a robust manual grinder and polisher for fast, reliable specimen preparation. It is Ø300 mm in size and has interchangeable discs of varying grit.

## Struers Duramin-40 AC2 hardness tester

The Struers Duramin-40 AC2 is a versatile micro / macro hardness tester with load cell technology for the automatic testing of Vickers, Knoop, and Brinell methods. It has an extended test load range of 0.098 – 306.4 N (10 gf – 31.25 kgf) and test height of 0 – 148 mm. It features an integrated PC, touchscreen, high-resolution evaluation camera, automatic illumination, automatic focus, automatic image evaluation, motorised Z-axis, motorised XY-stage (size 350 x 225 mm<sup>2</sup>, X-axis travel of 220 mm, Y-axis travel of 120 mm), motorised 6 + 1 position turret, software for a fully automatic evaluation, and an overview camera with 200 x 160 mm<sup>2</sup> field of view.

## Hysitron TI 900 TriboIndenter

The Hysitron TI 900 TriboIndenter is used for high-throughput testing and collecting of nanoindentation, scratch, and wear data. It features in situ Scanning Probe Microscopy (SPM) imaging and a heating stage.

## Olympus LEXT OLS5000 3D Confocal Laser Scanning Microscope

The Olympus LEXT OLS5000 is a 3D Confocal Laser Scanning Microscope (CLSM) used for fast, non-contact, non-destructive imaging and measuring without sample preparation. It features XY-axis lateral resolution of 120 nm and Z-axis resolution of 10 nm, image slopes of up to 87.5°, and stage travel of 100 mm in both the X-axis and Y-axis. It can be used for the visualisation of nanometre micro surface contours using Differential Interference Contrast (DIC), as well as profile and surface roughness measurements.



# Design tools

## High-performance workstation

Our custom-built high-performance workstation contains bespoke software solutions that enable complex part modelling and analysis, as well as build preparation and simulation. It is available for all users at the Sydney Manufacturing Hub.

## SolidWorks

SolidWorks is a solid modelling computer-aided design (CAD) application used for creating and editing parts for additive manufacturing.

## Materialise Magics

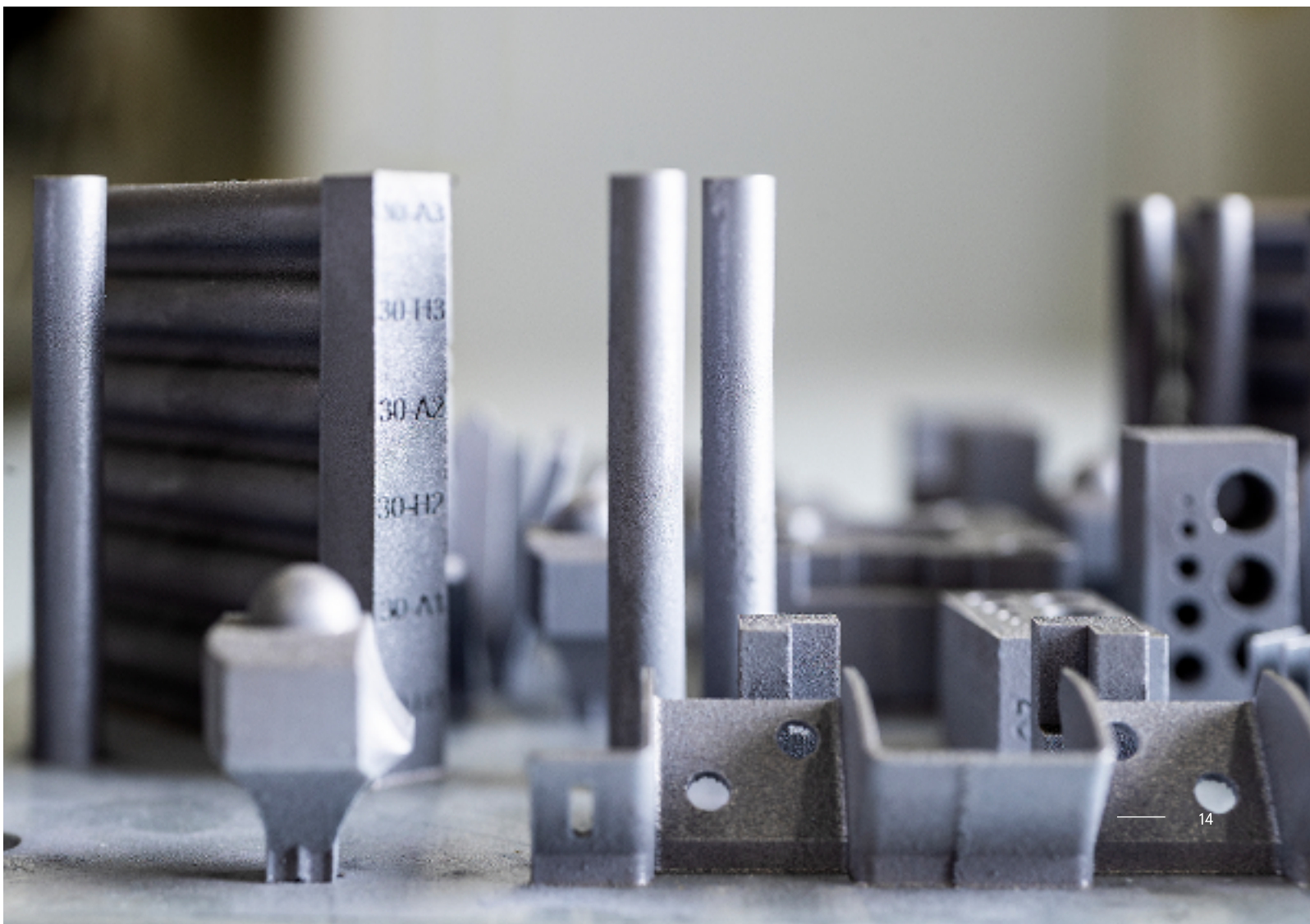
Materialise Magics is a file editing and build preparation application for additive manufacturing, used for file conversion, repairing and optimising models, support generation, slicing, and outputting files to be read by the 3D printers. At the Sydney Manufacturing Hub we use it as part of the powder bed fusion machine workflow.

## Simplify3D

Simplify3D is a build preparation application, used for infill and support generation, slicing, and converting model geometry to g-code that a 3D printer can read and understand.

## FLOW-3D

FLOW-3D is simulation application that can be used to study the flow of liquid or gas under complex scenarios using computational fluid dynamics. It can also be used to understand how the melting and layering processes work in various additive manufacturing technologies.



For more information:

Sydney Manufacturing Hub  
Room S260, Mechanical Engineering J07  
The University of Sydney NSW 2006  
Australia

+61 2 8627 9882  
[smh.info@sydney.edu.au](mailto:smh.info@sydney.edu.au)  
[sydney.edu.au/manufacturing-hub](https://sydney.edu.au/manufacturing-hub)