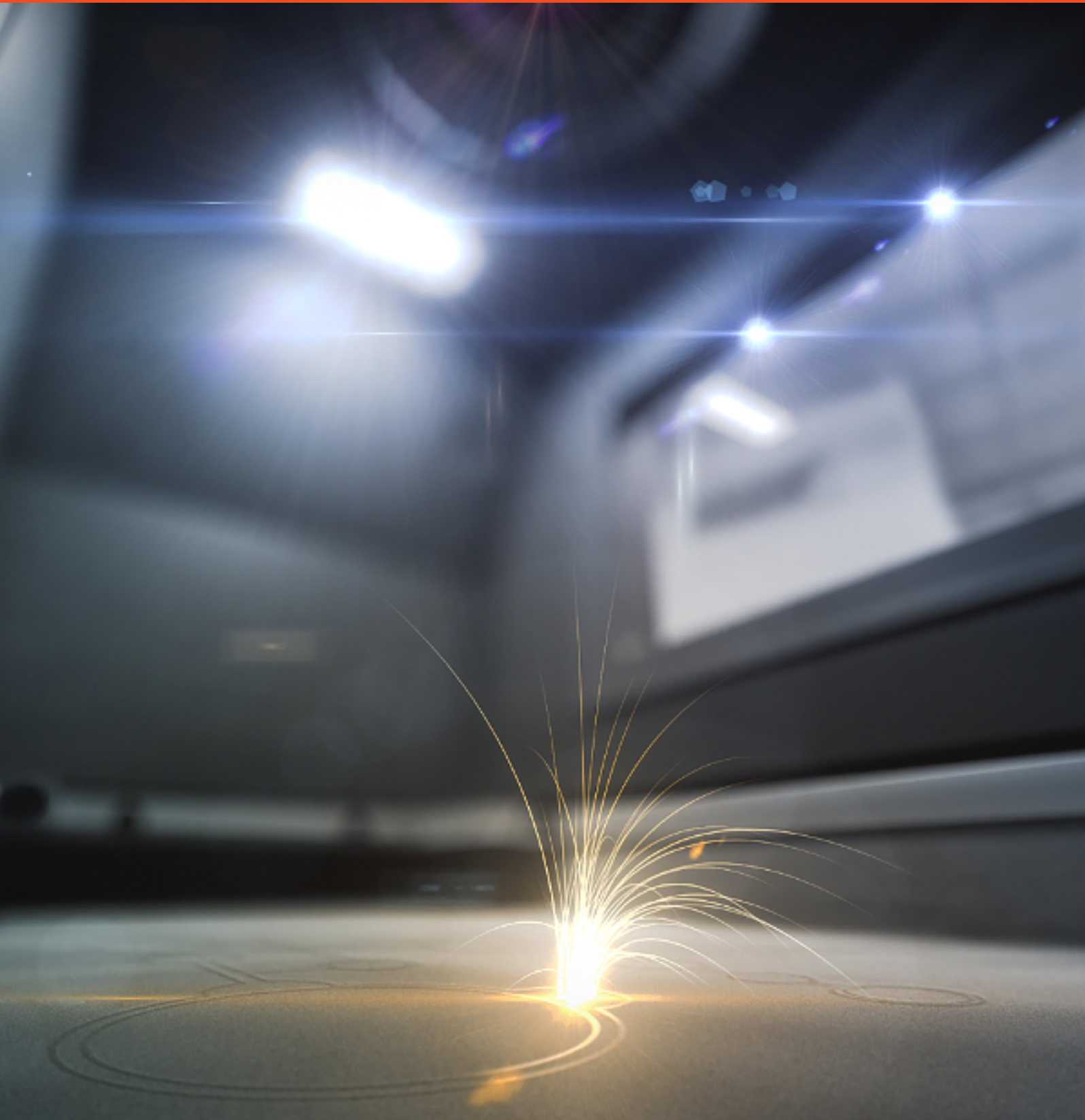


Sydney Manufacturing Hub



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 ³
Laser System:	200 W fibre laser
Laser Spot Size:	75 µm
Recommended 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 ³
Laser System:	2 x 400 W fibre lasers
Laser Spot Size:	70 – 500 µm (variable)
Recommended 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 ³
Electron Beam System:	3 kW
Build Chamber Temperature:	600 – 1,100°C
Recommended Layer Thickness:	20 – 100 µm *material dependent

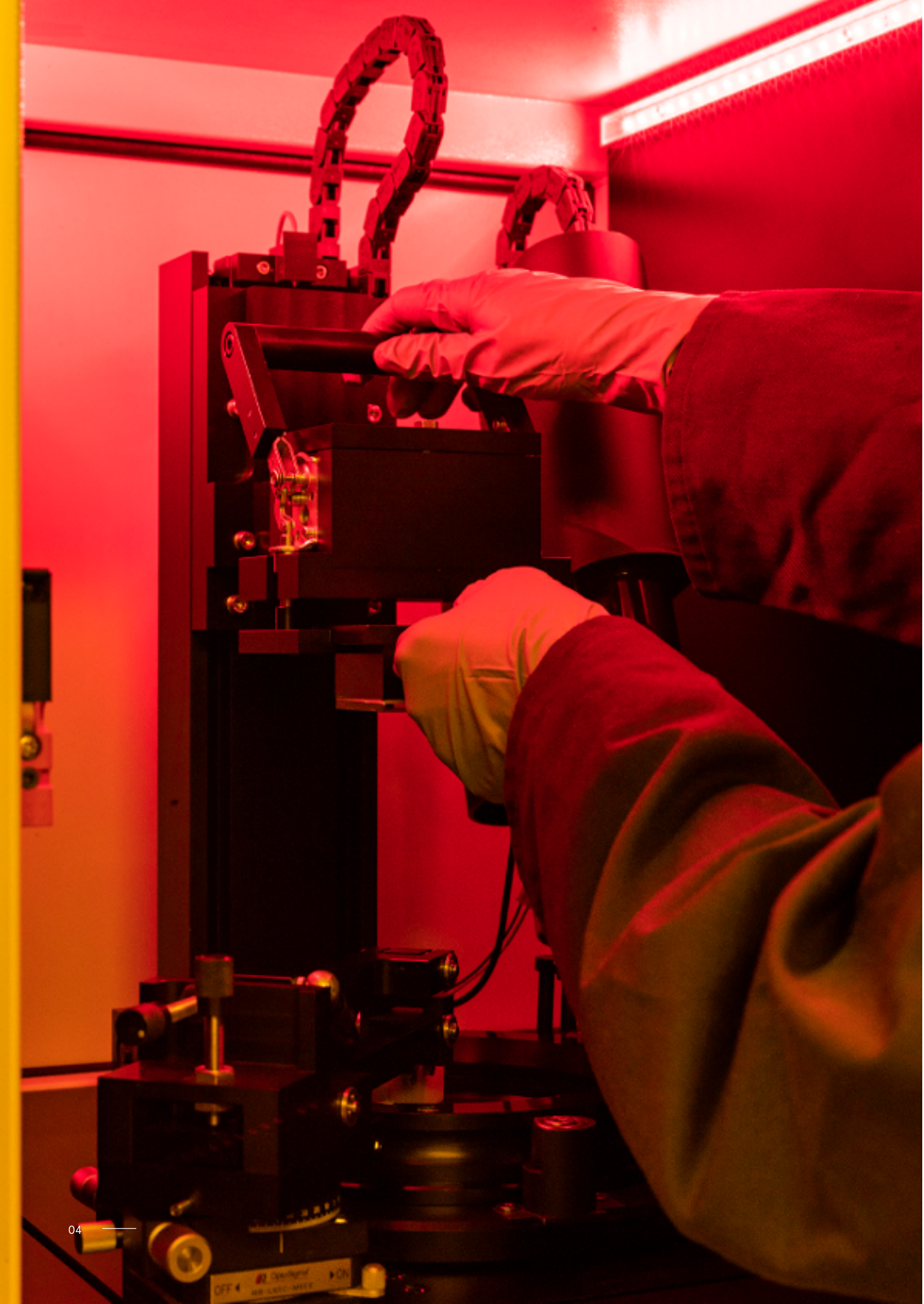
Arcam Spectra H

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



Materials	Available on Laser Beam platforms	Available on Electron Beam platforms
Al-Si7-Mg aluminium alloy	X	
Al-Si10-Mg aluminium alloy	X	
17-4 PH stainless steel	X	
316 L stainless steel	X	
Cu-Sn10 bronze	X	
CP Ti (Gr 2) titanium	X	
Ti-6Al-4V ELI (Gr 23) titanium alloy	X	X
Inconel 625 nickel-based superalloy	X	
Inconel 718 nickel-based superalloy	X	X
Cobalt-chromium-tungsten alloy	X	

These materials are what we currently have on hand, please contact us if you want to print with other materials.



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 ³
Light Source:	LED
Lateral Resolution:	40 µm (Full HD)
Layer Thickness:	10 – 100 µm *material dependent
Build Speed:	Up to 100 slices per hour
Supported Materials:	Aluminium nitride Zirconia-toughened aluminium oxide Aluminium oxide-toughened zirconia Aluminium oxide Yttria-stabilised zirconia Silica-based Silicon nitride Tricalcium phosphate Hydroxyapatite Quartz glass (transparent) 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 ³
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.

Technology:	Vat Photopolymerisation – Liquid Crystal Display (LCD)
Build Volume:	330 x 185 x 400h mm ³
Light Source:	405 nm ParaLED Matrix 3.0
Lateral Resolution:	43 µm (8K)
Layer Thickness:	10 – 300 µm
Build Speed:	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.

Technology:	Vat Photopolymerisation – Liquid Crystal Display (LCD)
Build Volume:	165 x 72 x 180h mm ³
Light Source:	Linear Projection LED Module
Lateral Resolution:	22 µm (8K)
Layer Thickness:	10 – 300 µm
Build Speed:	Up to 80 mm per hour

Formlabs 3BL

The Formlabs 3BL is a large-format 3D printer developed for medical professionals. It can 3D print patient-specific anatomy at 1:1 scale or large medical devices in a single build, and is compatible with the majority of the Formlabs materials library, including biocompatible and sterilisable materials.

Technology:	Vat Photopolymerisation – Stereolithography (SLA)
Build Volume:	335 x 200 x 320h mm ³
Light Source:	2 x 250 mW lasers with 85 µm spot size
Lateral Resolution:	25 µm
Layer Thickness:	25 – 300 µm

Formlabs Form 3+

The Formlabs Form 3+ 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.

Technology:	Vat Photopolymerisation – Stereolithography (SLA)
Build Volume:	145 x 145 x 185h mm ³
Light Source:	250 mW laser with 85 µm spot size
Lateral Resolution:	25 µm
Layer Thickness:	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 ³
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:	200 – 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 ³
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:	200 – 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, and is equipped with dual extruders with individual temperature controls.

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 ³
Hot End Temperature:	Up to 295°C
Build Plate Temperature:	Up to 145°C
Layer Thickness:	200 – 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 ³
Hot End Temperature:	Up to 300°C
Build Plate Temperature:	Up to 120°C
Layer Thickness:	200 – 350 µm

Welding capabilities

Stirweld FSW Head

The Stirweld Friction Stir Welding (FSW) head is an attachment that allows existing 3, 4, or 5-axis CNC machine tools to perform friction stir welds.

It uses a spring-loaded tool holder that protects the spindle against loads and vibrations. When the head is brought a set distance from the workpieces, the springs are compressed and the resultant forging force pushes the rotating tool into the material, generating the friction, heat, and compression required to make successful welds.

Melting & alloying capabilities

Edmund Buhler AM 500 Arc Melter

The Edmund Buhler AM 500 arc melter is used for melting metals up to 500 g at temperatures up to 3,500°C, 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.

Indutherm VTC 200 V Tilt Casting Machine

The Indutherm VTC 200 V tilt casting machine is used for melting and casting metals at temperatures up to 2,100°C.

It uses induction heating for melting the metals, which are then poured into a mould to form the desired shape. The volume of the ceramic crucible is 180 cm³ and the graphite mould is 145 cm³.

It provides reliable and efficient melting and casting of a wide range of metals.





CONCEPTLASER
a GE Additive company

QM
powder

Pre-processing capabilities

METALS

TURBULA T 2 GE 3D Shaker Mixer

The TURBULA T 2 GE 3D Shaker Mixer is used for blending powders and granular materials of different specific weights and particle sizes to produce homogeneous mixtures.

It features a programmable 3D motion, infinitely variable speed regulation, and timer function, to allow for standardised processes with reproducible results.

POLYMERS

Noztek fusionX Extruder

The Noztek fusionX extruder 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

Quintus QIH 15L M URQ + URC HIP

Hot Isostatic Pressing (HIP) uses an elevated temperature and high isostatic gas pressure to eliminate internal defects and achieve as close to a fully dense material as possible.

Metal AM parts could contain internal defects such as shrinkage and gas porosity, lack of fusion between layers and residual porosity after sintering. These internal defects could act as stress concentration and crack initiation sites in the material which in turn could negatively affect the material properties and performance of the parts.

This HIP system is capable of Ultra Rapid Quenching (URQ) and Ultra Rapid Cooling (URC), a capability not found on most other HIP systems. For certain alloys, this allows HIP and solution heat treatment to be consolidated into a single step.

Temperature:	1,400°C (maximum operating)
Pressure:	207 MPa (maximum operating)
Workload Size:	Ø186 x 500h mm ³ (maximum)
Workload Mass:	60 kg (maximum)

Makino U6 H.E.A.T. EDM

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.

It is primarily used for removing metal AM parts from build plates, and profiling tensile bars for mechanical testing.

Table Size:	910 x 710 mm ²
Machining Size:	650 x 450 x 400h mm ³
U-Axis:	± 75 mm
V-Axis:	± 75 mm
Wire Electrode:	Ø0.05 – Ø0.40 mm

Blasting Cabinets

Two blasting cabinets, one with glass beads and the other with garnet media, for the surface finishing of parts.

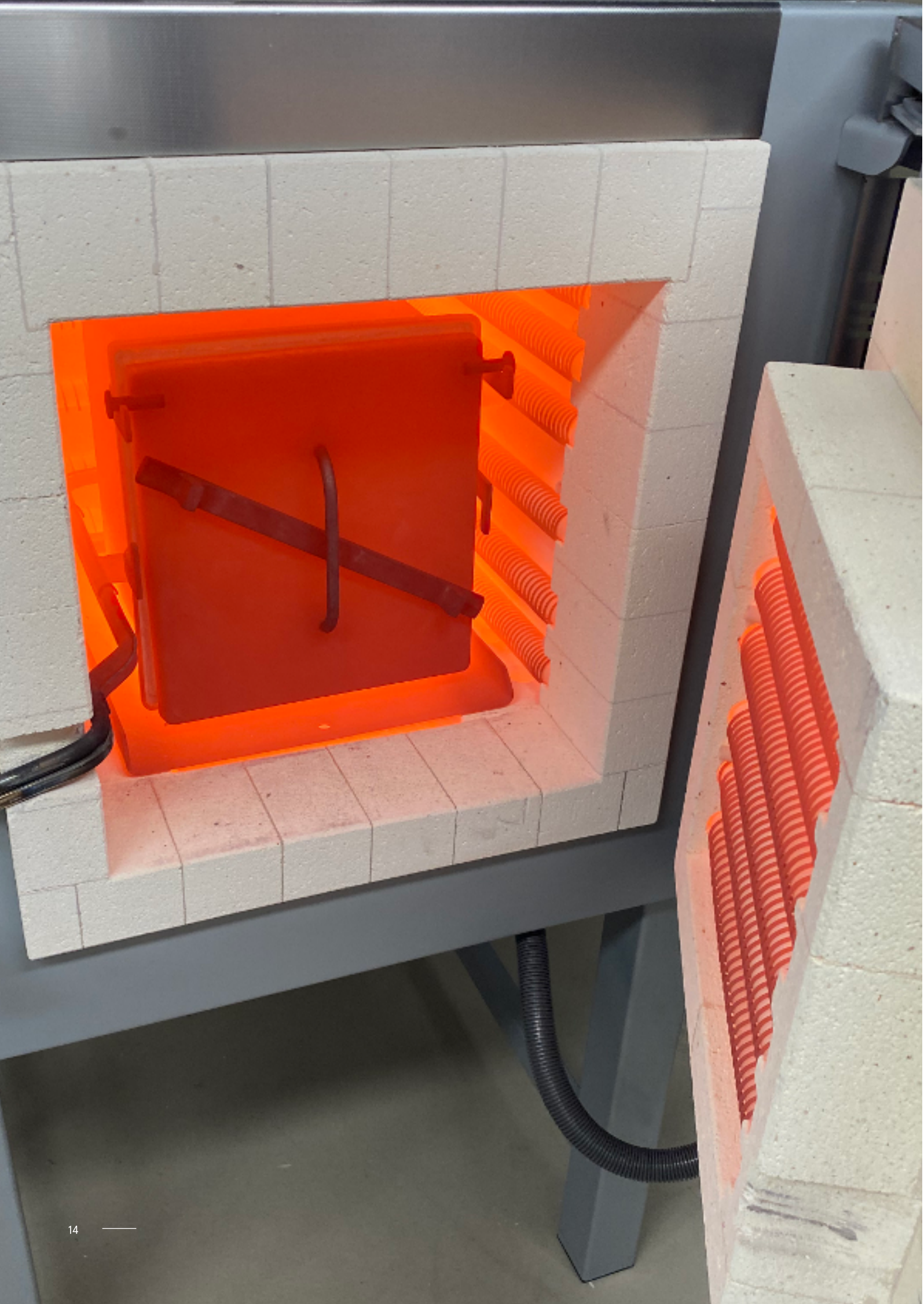
Ceramic Mass-Finisher

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).





Heat treatment capabilities

FURNACES

Nabertherm VHT 45/15-MO

Controlled atmosphere, high temperature cold-wall retort furnace, for the heat treatment of metal parts.

- Temperature: 1,450°C (peak)
1,400°C (maximum operating)
- Volume: 45 L – 300 x 300 x 500h mm³
- Environment: Argon, Nitrogen, or vacuum

Nabertherm VHT 08/18-W

Controlled atmosphere, high temperature cold-wall retort furnace, for the sintering of ceramics.

- Temperature: 1,800°C (peak)
1,750°C (maximum operating)
- Volume: 8 L – 170 x 240 x 200h mm³
- Environment: Argon, Nitrogen, or vacuum

Nabertherm LHTCT 08/16

For the debinding and sintering of ceramics.

- Temperature: 1,600°C (peak)
1,550°C (maximum operating)
- Volume: 8 L – 170 x 290 x 170h mm³
- Environment: N/A

Nabertherm LH 60/14

For the heat treatment of metal parts, can be used for quenching.

- Temperature: 1,400°C (peak)
1,350°C (maximum operating)
1,100°C (with gas box)
- Volume: 60 L – 400 x 400 x 400h mm³
- Environment: Air, Argon, or Nitrogen (with gas box)

Across International GCF 1700-125L

Controlled atmosphere muffle furnace, for the heat treatment of metal parts, can be used for quenching.

- Temperature: 1,700°C (peak)
1,650°C (maximum operating)
- Volume: 125 L – 500 x 500 x 500h mm³
- Environment: Air, Argon, or Nitrogen

OVENS

Nabertherm TR30 Drying Oven

- Temperature: RT to 300°C
- Volume: 30 L – 360 x 300 x 300h mm³

Nabertherm TR60 Drying Oven

- Temperature: RT to 300°C
- Volume: 60 L – 450 x 390 x 350h mm³

BATHS

Oil Baths

- Temperature: 80°C to 200°C
- Size: 500 x 300 x 200h mm³
- Temperature: 80°C to 260°C
- Size: 500 x 300 x 200h mm³

Salt Baths

- Temperature: 400°C to 550°C
- Size: Ø200 x 400h mm³
- Temperature: 500°C to 800°C
- Size: Ø100 x 250h mm³
- Temperature: 850°C to 1,050°C
- Size: Ø100 x 250h mm³

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 LaboPol-30 is a robust grinder and polisher for fast, reliable specimen preparation, and is equipped with the LaboForce-100 semi-automatic specimen mover.

It is Ø300 mm in size with interchangeable grinding discs and polishing cloths. The specimen mover plate allows the preparation of up to six specimens and the flexible specimen holder can hold irregular shaped specimens.

Olympus LEXT OLS5000 3D CLSM

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 can be used for the visualisation of nanometre micro surface contours using Differential Interference Contrast (DIC), as well as profile and surface roughness measurements.

Lateral Resolution:	120 nm
Vertical Resolution:	10 nm
Image Slope:	Up to 87.5°
Stage Travel:	100 mm (X-axis and Y-axis)

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 and Knoop methods. It can also be used for measuring material toughness (KC).

It features a high-resolution evaluation camera, automatic illumination, automatic focus, automatic image evaluation, motorised Z-axis, motorised XY-stage, motorised 6 + 1 position turret, and software for a fully automatic evaluation.

Load Range:	0.098 – 306.4 N (10 gf – 31.25 kgf)
Stage Size:	350 x 225 mm ²
Stage Travel:	220 mm (X-axis) and 120 mm (Y-axis)
Test Height:	0 – 148 mm
Camera FOV:	200 x 160 mm ²

Hysitron TI 900 TriboIndenter

The Hysitron TI 900 TriboIndenter is used for high-throughput testing and collecting of nanoindentation, scratch, and wear data.

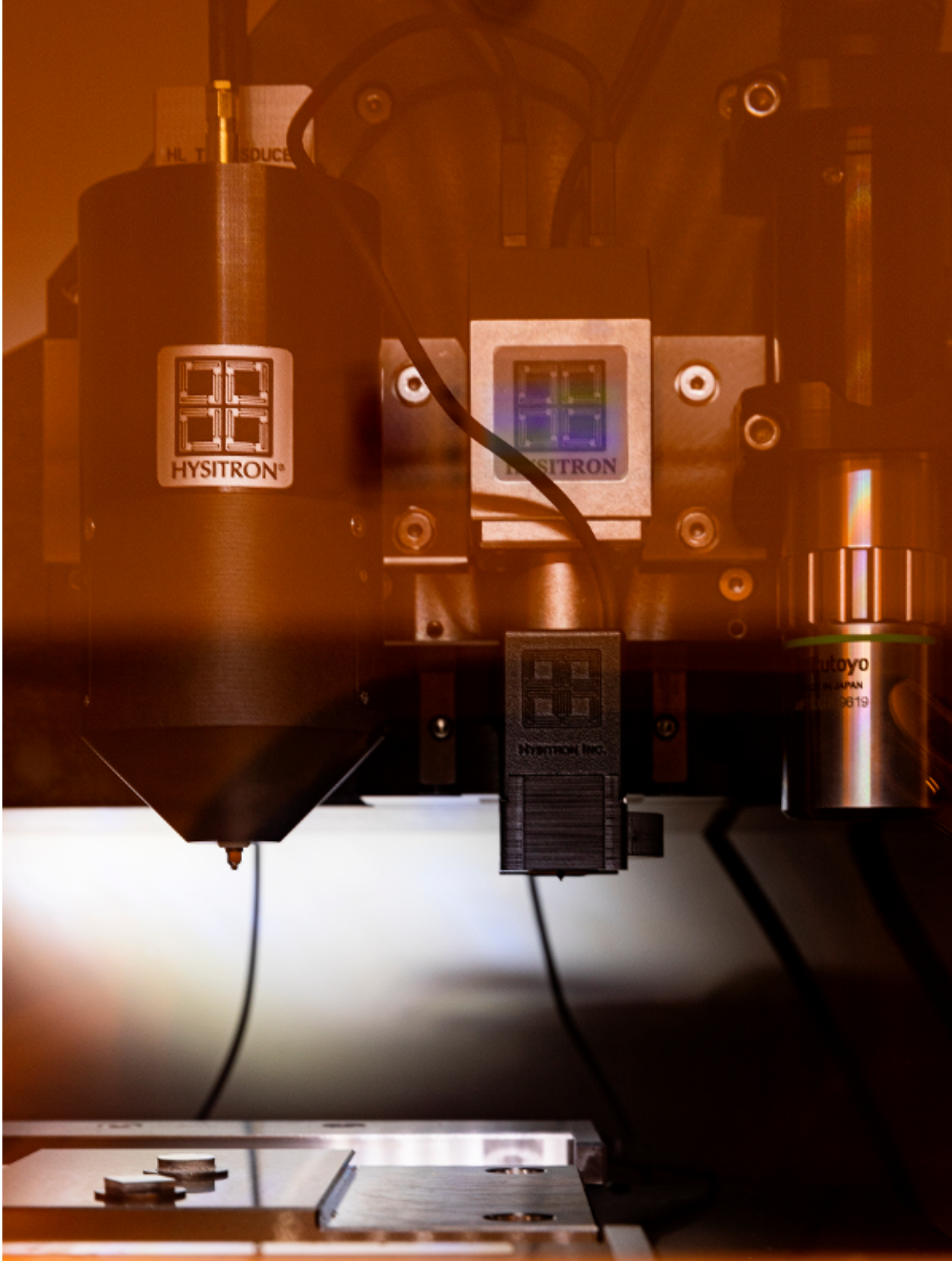
It features in situ Scanning Probe Microscopy (SPM) imaging.

Plastometrex PIP Tester

The Plastometrex Profilometry-based Indentation Plastometry (PIP) tester is used for obtaining an isotropic material's stress-strain curve from an indent profile by using accelerated inverse Finite Element Analysis (FEA).

Compared with conventional tensile testing, PIP testing can be conducted with up to 99% less material and at up to 80 times faster, substantially reducing the cost and time to develop new alloys.

The PIP tester has a hot stage allowing testing at up to 800°C, a process that would be much more expensive and complicated to perform with conventional tensile testing.



Design tools

HIGH-PERFORMANCE WORKSTATIONS

Our custom-built high-performance workstations contain software enabling complex computer-aided design (CAD) part modelling and analysis, as well as build preparation and simulation. They are available for all users.

CAD Workstation

CPU: AMD Ryzen Threadripper PRO 5965WX
(24 cores, 48 threads, 3.8 to 4.5 GHz)
RAM: 128 GB, 3200 MHz
GPU: Nvidia RTX 6000 48 GB

Software Applications:

- SolidWorks
- Materialise Magics

Simulation Workstation

CPU: AMD Ryzen Threadripper 3970X
(32 cores, 64 threads, 3.7 to 4.5 GHz)
RAM: 128 GB, 3200 MHz
GPU: Nvidia RTX 5000 16 GB

Software Applications:

- Ansys
- FLOW-3D
- Simplify3D



SOFTWARE APPLICATIONS

SolidWorks

SolidWorks is an industry-standard application for the designing and engineering of parts and assemblies.

It is capable of solid and surface modelling of highly complex parts, and because of its parametric modelling approach these parts are also highly modifiable.

It is used for creating parts for additive manufacturing.

Rhino

Rhino is an application that uses Non-Uniform Rational B-Splines (NURBS) in the modelling of complex surfaces.

Its modelling ability, point cloud support, and compatibility with a large range of file formats, makes Rhino a powerful and versatile tool for designing parts and editing meshes for additive manufacturing.

Ansys

Ansys is an extremely powerful simulator and solver application.

It is used for conducting Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), and quickly and accurately analysing alternate design scenarios to establish a preferred design solution.

FLOW-3D

FLOW-3D is a simulation application used to study the flow of liquid or gas through complex structures using Computational Fluid Dynamics (CFD).

It can also be used to understand how the melting and layering processes work in various additive manufacturing technologies.

Materialise Magics

Materialise Magics is a file editing and build preparation application.

It is used for converting files, repairing and optimising models, generating supports, slicing builds, and outputting build geometry to a format that can be understood by the 3D printers.

Simplify3D

Simplify3D is a build preparation application.

It is used for generating infills and supports, slicing builds, and outputting build geometry to g-code that can be understood by the 3D printers.

Peregrine

Peregrine is an application for metal powder bed fusion additive manufacturing processes.

It integrates in situ sensing, data analytics, and artificial intelligence to predict potential build issues or failures in real time.

It is 3D printer agnostic, and is currently used on the Concept Laser M2 Dual Laser, enabling seamless data collection and analysis across laser beam and electron beam platforms.

Reverse engineering & conformity inspection tools

ZEISS ATOS Q ScanCobot

The ZEISS ATOS Q is a blue structured-light 3D scanner used to measure the surface geometry of complex parts, it is highly versatile and can be used in reverse engineering and conformity inspection operations.

It captures 8 million points per scan at 40 μm resolution and single-digit μm accuracy, and has interchangeable optics for 170 mm and 350 mm measuring volumes.

It is attached to a 6-axis cobot and orbits a 7th axis rotation table, and can be configured for fully autonomous scanning and measuring.

ZEISS INSPECT Optical 3D Software

Complementing the 3D scanner is the ZEISS INSPECT Optical 3D software.

The software supports the configuration and operation of the 3D scanner via the Virtual Measuring Room (VMR).

Then, with the data collected, it guides you through the process of nominal-actual comparisons as well as Geometric Design & Tolerancing (GD&T) inspections, and the publishing of comprehensive reports with easy-to-understand results.



For more information:

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