AM @ RMIT

M. Brandt

Director

Advanced Manufacturing Precinct - Digital Manufacturing Facility

Centre for Additive Manufacturing

What's next…

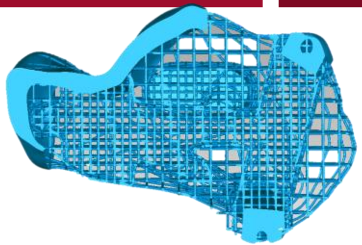
RMIT UNIVERSITY

RMIT Centre for Additive Manufacturing - 2014
RCAM Vision

To be a global research leader in digital additive manufacturing delivering innovative solutions to industry.

Academic Members	Visiting Professors	Full-time Researchers	PhD Students
21	4 average per year	16	>35 current >120 graduated (since 2014)

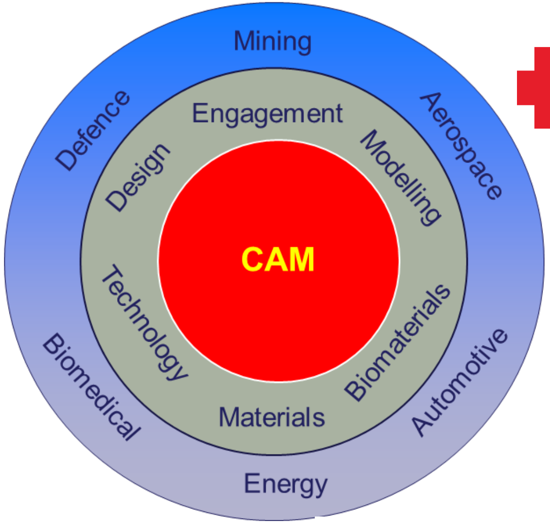




Key researchers

Prof Milan Brandt
AM, laser, materials, manufacturing

Prof Kate Fox
AM, surfaces, biomaterials, manufacturing



Prof Ma Qian
Materials
metals, materials, Ti expertise

A/Prof Jonathan Tran
Civil, modelling
AM concrete

Prof Pier Marzocca
aerospace structures

A/Prof Andrey Molotnikov
Technology
laser, materials, sensors, manufacturing

Prof Mark Easton
metals, materials, Al alloy expertise

Prof Raj Das
Modelling
Modelling, AM,

Prof Martin Leary
Design
AM, design for AM

Prof Stuart Bateman
AM, polymers, manufacturing

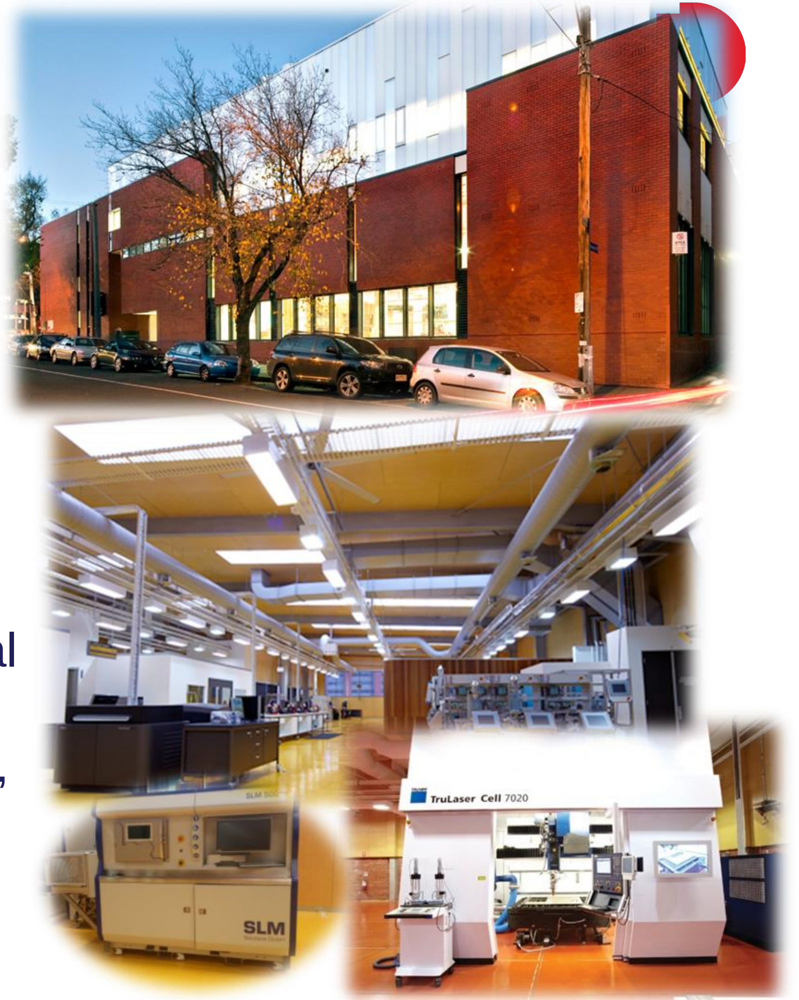
Prof Cui Wen
Biomateriials
materials, metals, biomaterials

CAM Theme Leaders

AMP

Undertaking fundamental and applied research and training in digital additive manufacturing in support of the local manufacturing industry

- World class $30m research and teaching facility – opened 2010
- Unique in Australia – covers both metal and polymer based technologies together with high-end CNC machines, 3D scanning, mechanical testing (**One stop shop for Industry)**



RMIT Additive manufacturing capability - 2023

Polymer

FDM – Fortus 900mc, Zortrax, Markforge

MJ – Polyjet J750, Connex 350,

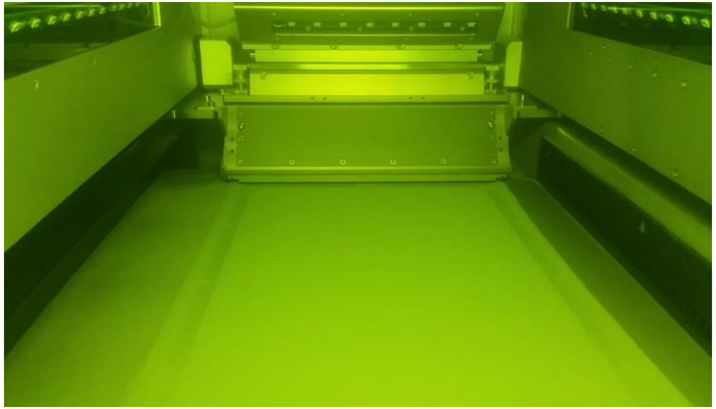
SLA – 3D Systems Projet 7000, DLP systems

RMIT Additive manufacturing capability - 2023

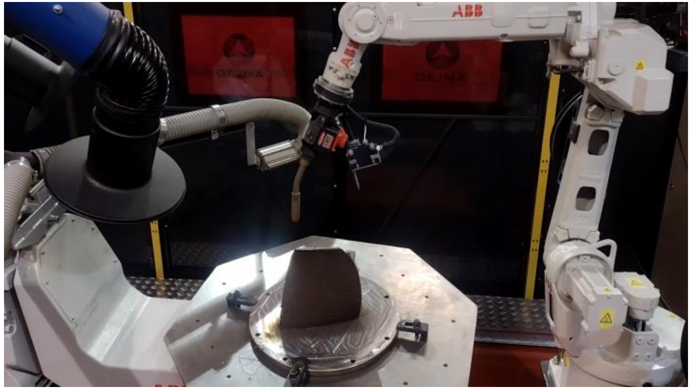
Metal

LPBF – SLM Solutions 500HL, 2x250HL, 125HL, 280 HL (Dec 23)

Aconity Midi+



WAAM – AML3D



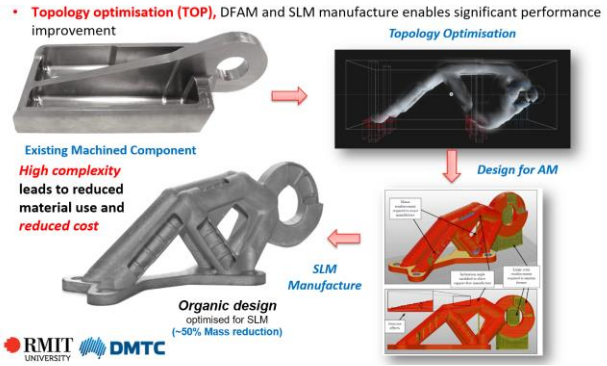
Aconity***MIDI+*** – Multi-Material, 1000deg, sensors

LMD – TRUMPF TruLaser 7020, Range of thermal sensors, Multi-material

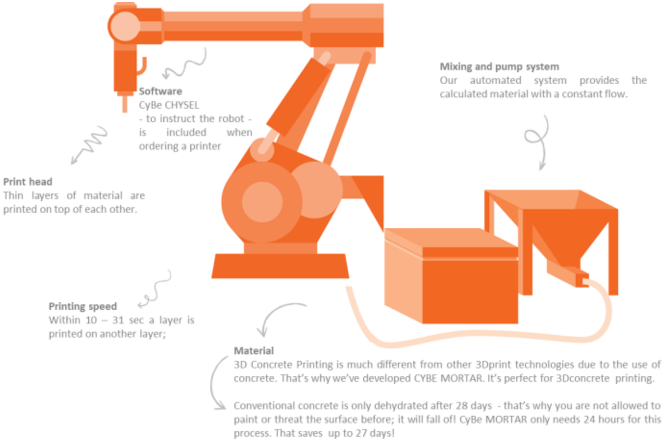
RMIT Additive manufacturing capability - 2023

Supporting

CNC – 3 & 5 Axis machining centres
Metrology – 3D scanning, CMM, CT
Simulation – Virtual design, Optimisation
Mechanical Testing – Extensive capabilities



RMIT Additive manufacturing capability – Prefab construction



- 200-600 mm/s print speed
- 4.5 m height & 2.75 m range
- Modular construction method

Applied research underpinned by high impact fundamental research

Article

Strong and ductile titanium–oxygen–iron alloys by additive manufacturing

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Open access
Check for u

Tingting Song[1,7], Zibin Chen[2,3,4,5,7], Xiangyuan Cui[2,3], Shenglu Lu[1], Hansheng Chen[2,3], Hao Wang[2,3], Tony Dong[6], Bailiang Qin[4], Kang Cheung Chan[4,5], Milan Brandt[1], Xiaozhou Liao[2,3], Simon P. Ringer[2,3]✉ & Ma Qian[1]✉

Titanium alloys are advanced lightweight materials, indispensable for many critical applications[1,2]. The mainstay of the titanium industry is the α–β titanium alloys, … α and β phases[3–5]. … ing element … re readily ab … y as 'the kry … ir combinat … iron alloys. I

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Research paper

Ti-6Al-4V hollow-strut lattice materials by laser powder bed fusion

J. Noronha, J. Rogers, M. Leary, E. Kyriakou, S.B. Inverarity, R. Das, M. Brandt, M. Qian*
Centre for Additive Manufacturing, School of Engineering, RMIT University, Melbourne, VIC 3000, Australia

ARTICLE INFO
Keywords:
Hollow-strut lattice
Additive manufacturing
Mechanical properties
Ti-6Al-4V

ABSTRACT
Hollow-strut metal lattices are an emerging class of cellular metallic materials. However, their mechanical properties at relative densities (ρ_{RD}) higher than 10% are largely unknown because conventional manufacturing methods are ill-equipped to fabricate them. In this study, face-centered cubic (FCC) and FCC with Z-struts (FCCZ) Ti-6Al-4V hollow-strut lattices with ρ_{RD} = 8–16% were fabricated using laser powder bed fusion (LPBF) additive manufacturing (AM). Both lattice topologies exhibited yield strength (σ^*) and elastic modulus (E^*) at the upper … he difference in σ^* or E^* … rut FCC and FCCZ lattices. … ollow-strut FCC and FCCZ … In addition, to the lattice

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journal homepage: www.journals.elsevier.com/scripta-materialia
ELSEVIER

Node-reinforced hollow-strut metal lattice materials for higher strength

J. Noronha, J. Dash, M. Leary, D. Downing, E. Kyriakou, M. Brandt, M. Qian*,1
Centre for Additive Manufacturing, School of Engineering, RMIT University, Melbourne, VIC 3000, Australia

ARTICLE INFO
Keywords:
Hollow strut
Lattice
Laser powder bed fusion
Metamaterials
Ti-6Al-4V

ABSTRACT
Intricate hollow-strut metal lattices are novel cellular materials or metamaterials. However, their hollow nodal regions often lead to premature failure under stress. This study reports a design strategy to substantially improve the strength of hollow-strut metal lattices by applying nodal reinforcement. The proposed nodal reinforcement designs increased the yield strength of hollow-strut Ti-6Al-4-V cubic lattices by up to 144% and elastic modulus by up to 113% with a modest 21% increase in density compared to the unreinforced lattices. In addition, a 42% increase in peak stress was observed when compared to solid-strut Ti-6Al-4-V cubic lattices of similar densities. These properties exceeded the empirical upper limits of the Gibson-Ashby model for cellular metallic materials, thus extending the property envelope. Distinct failure modes were observed for the proposed nodal reinforcement designs. Numerical analysis clarified their role in determining the deformation response.

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Variant selection in additively manufactured alpha-beta titanium alloys

S.L. Lu, C.J. Todaro[1], Y.Y. Sun, T. Song, M. Brandt, M. Qian*
Centre for Additive Manufacturing, School of Engineering, RMIT University, Melbourne, VIC 3000, Australia

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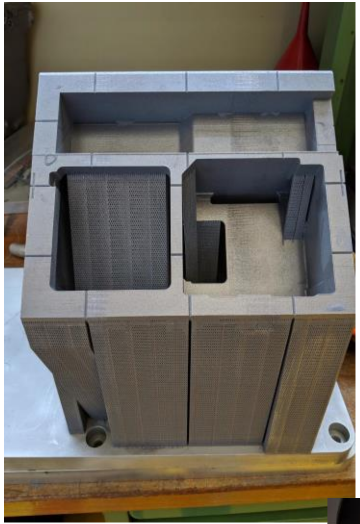
ABSTRACT
The crystallographic arrangements of the α-phase variants in α-β titanium alloys remains less identified due to the crystallographic complexity involved while being essential to understand the α-β microstructural intricacy. To improve the current understanding, specimens of two columnar-grained α-β Ti alloys (Ti-6Al-4V and Ti-6Al-2Sn-4Zr-2Mo) and two equiaxed-grained α-β Ti alloys (Ti-6Al-4V and Ti-4Al-2V) were fabricated by laser metal powder deposition (LMD). Electron backscatter diffraction (EBSD) analy-

Centre "firsts" based on fundamental research

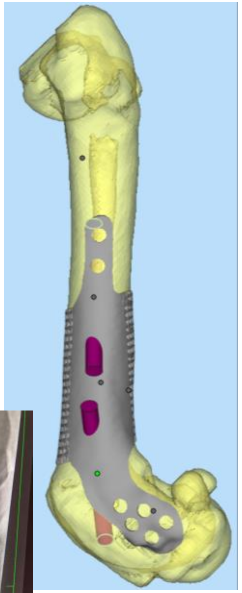

THE AUSTRALIAN
NEWSPAPER OF THE YEAR
HEALTH AND SCIENCE
Surgeons print out 3D body implant for spinal operation
Neurosurgeon Marc Coughlan.
RICHARD GUILLIATT
The Australian | 12:00AM August 15, 2015
Save

First 3D printed spinal disc in 2015 –
Collaboration with Anatomics



First 3D printed dog implant in 2019 –
Collaboration with UQ

Seymore 24h post op



First 3D printed satellite chassis 2019/20 –
Collaboration with ADFA

Collaboration Partners

LLT RWTH RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN
LEHRSTUHL FÜR LASERTECHNIK

BAE SYSTEMS

SWINBURNE UNIVERSITY OF TECHNOLOGY

LOCKHEED MARTIN

Quickstep

Agilent Technologies

RUAG

MIL-Systems Pty Ltd

ANCA TOTAL PRECISION

CHASSIS BRAKES INTERNATIONAL

FUTURIS

AUTODESK

ST VINCENT'S HOSPITAL MELBOURNE

Peter Mac Cancer Foundation

ADVANCED MANUFACTURING CRC

imcrc we champion manufacturing innovation

Anatomics

AutoCRC

DMTC DEFENCE MATERIALS TECHNOLOGY CENTRE

Advanced Development Programs

University of Wollongong

Australian Government ansto Australian Nuclear Science and Technology Organisation

WEIR MINERALS

Australian Government Department of Defence Defence Science and Technology Organisation

MONASH University

Fraunhofer IWS

Fraunhofer ILT

CSIRO

RMIT UNIVERSITY

Thank you for your attention.

Questions

What's next…