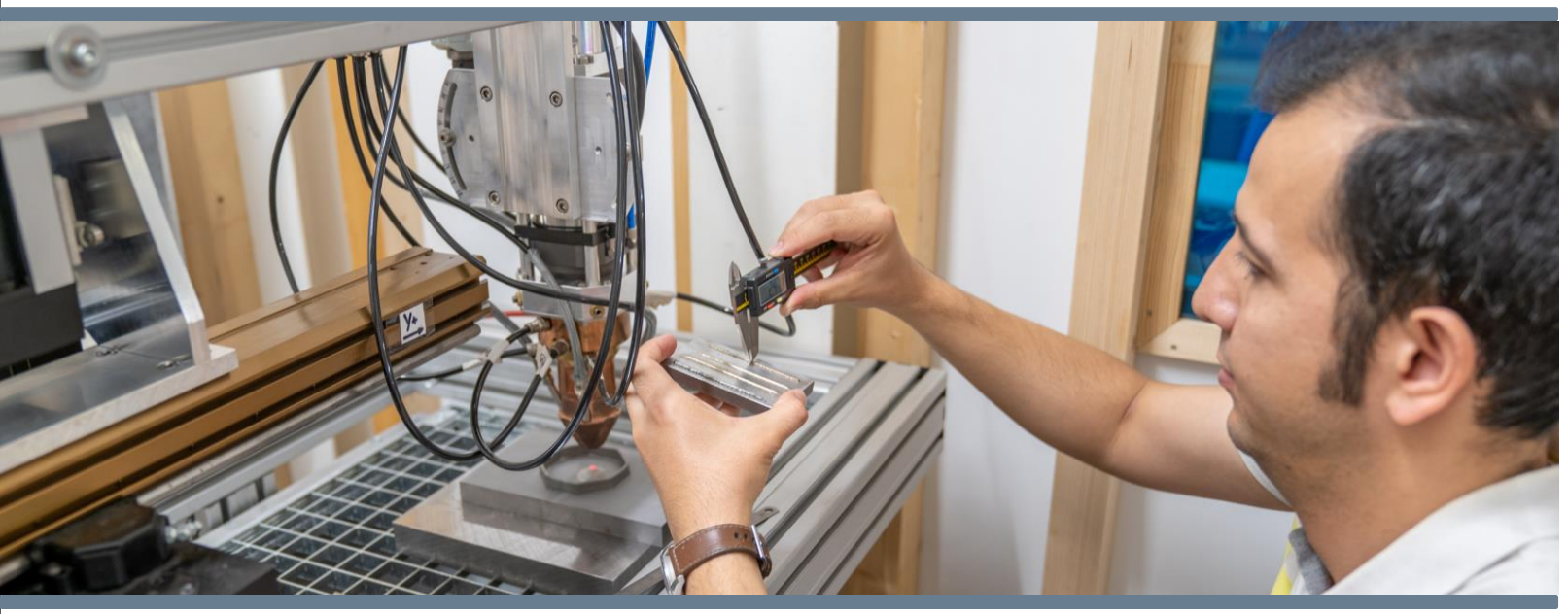
Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

SWISS PHOTONICS



In situ metal alloying by Direct Metal Deposition

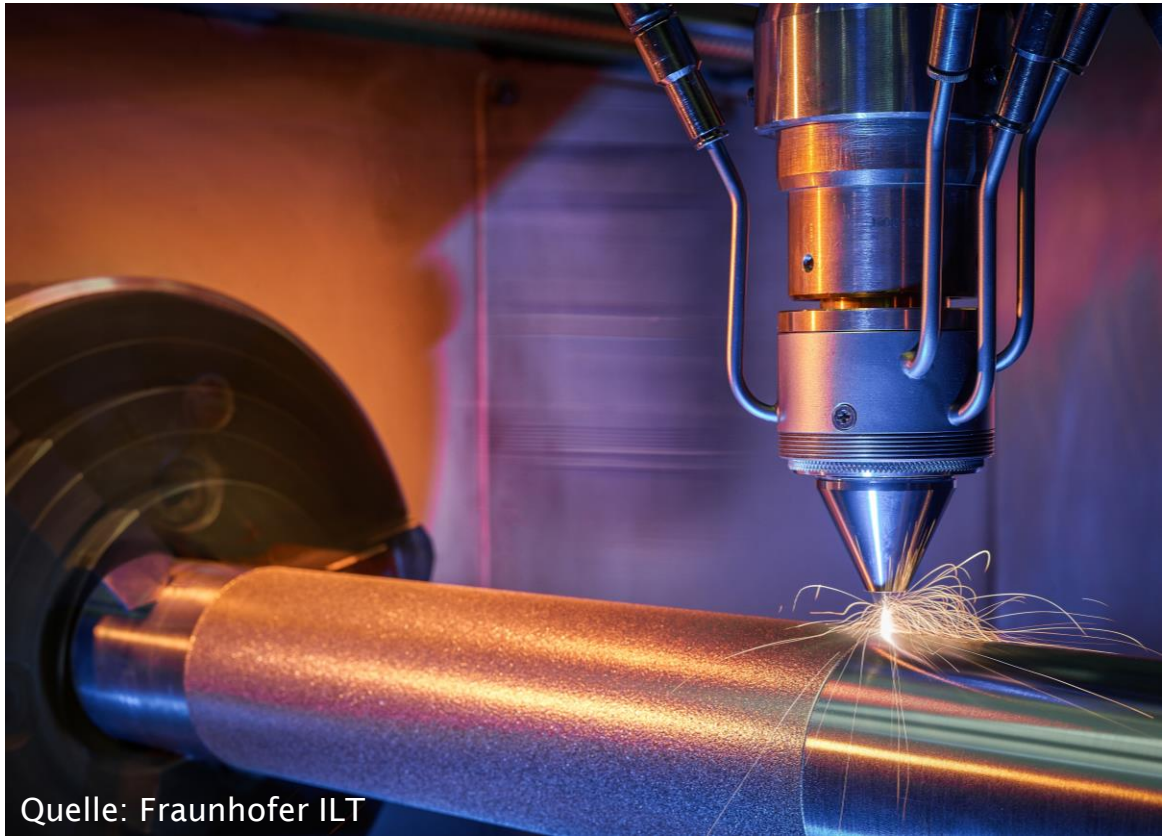
Thorsten Kramer,
Marco Fasel, Matthias Steck, Dr. Hossein Najafi, Prof. Dr. Valerio Romano

▶ Institute for Applied Laser, Photonics and Surface Technologies ALPS

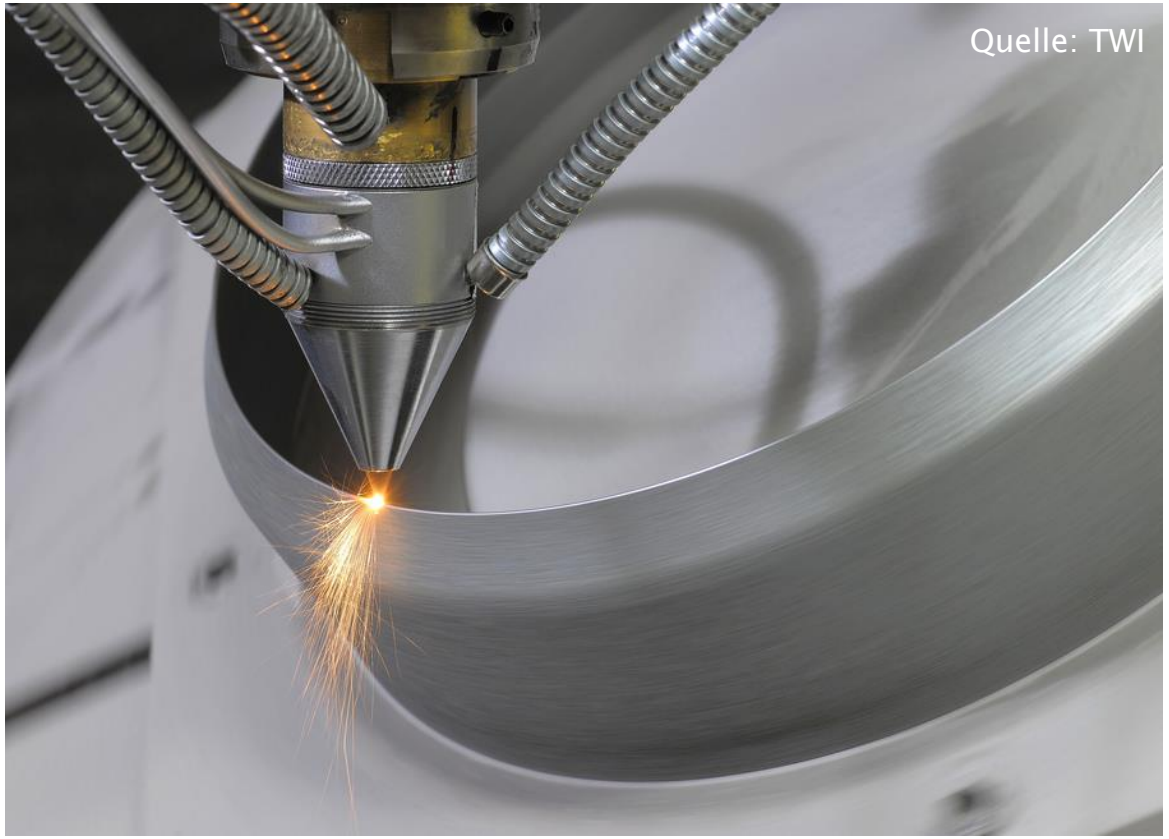
Quelle: Fraunhofer ILT

Introduction

Process Principle

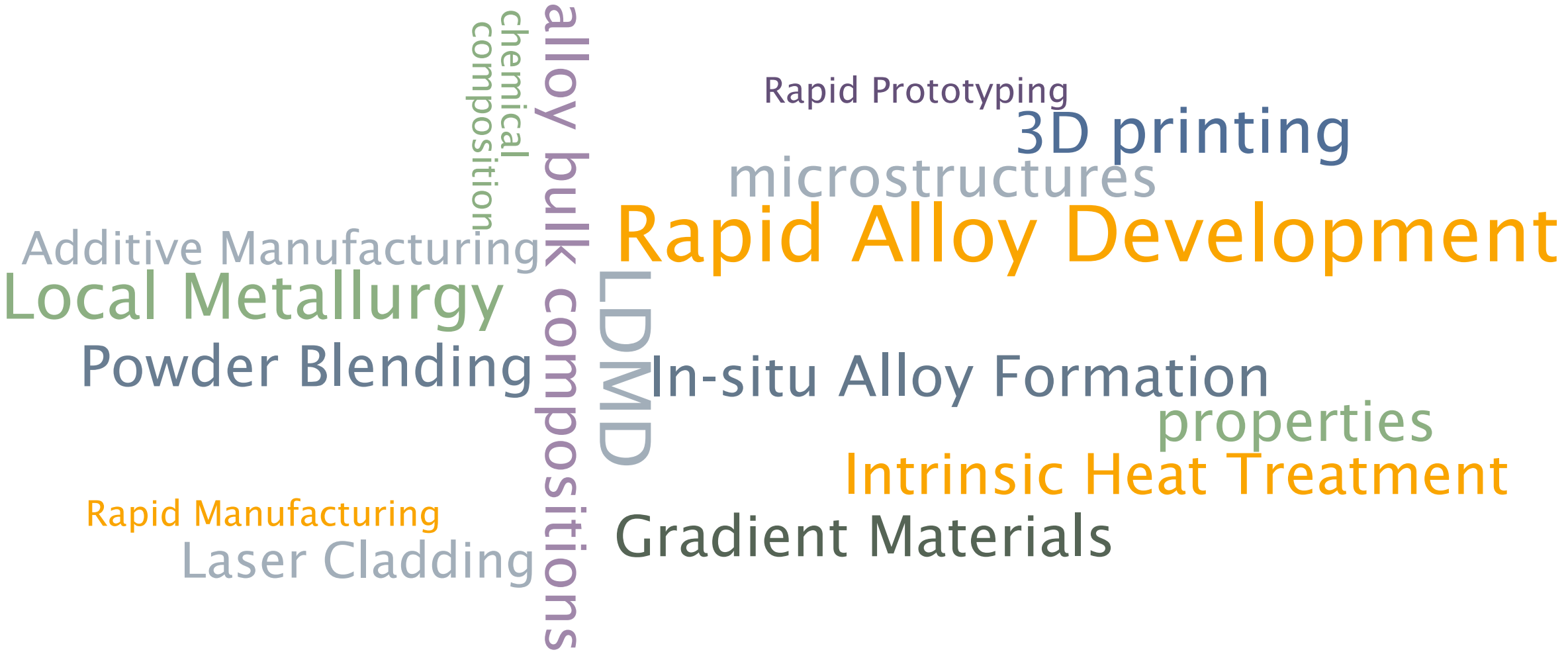


Quelle: Fraunhofer ILT

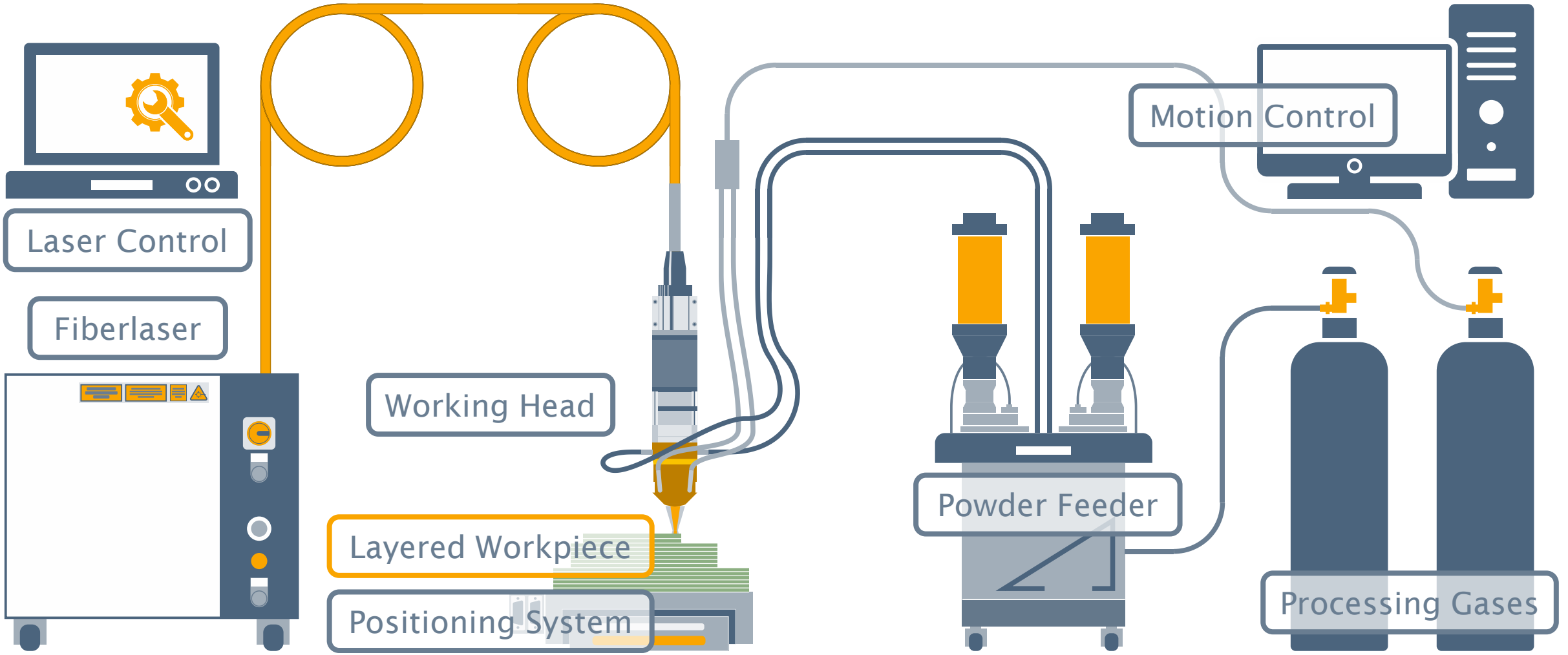


Quelle: TWI

Introduction

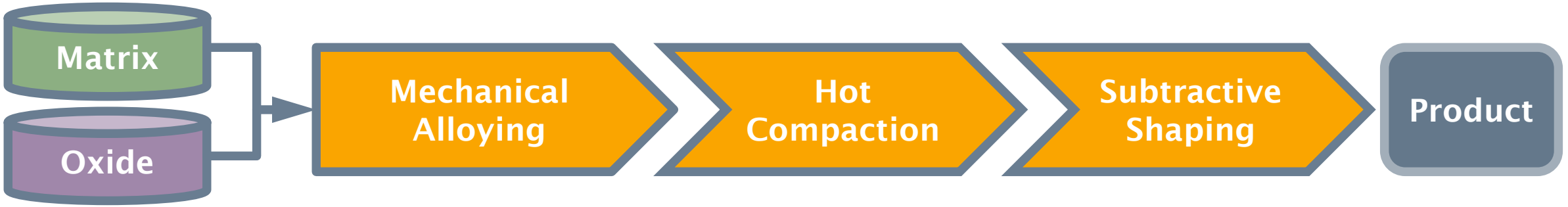


Introduction



Introduction

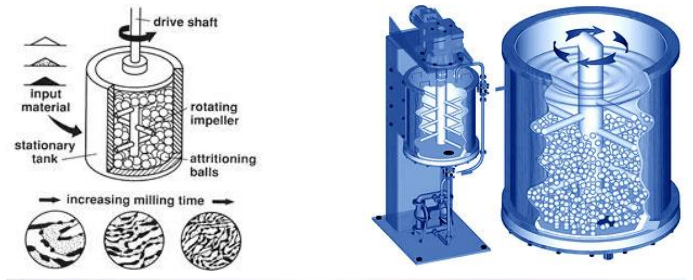
Conventional ODS Production



Laser Additive Manufacturing

Introduction

Conventional Route

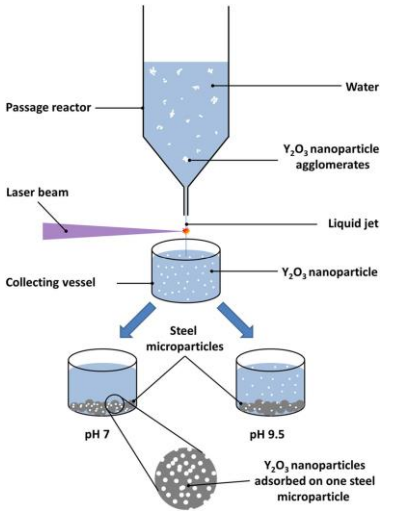


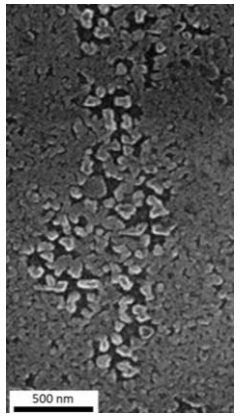
Mechanical Alloying
~48 h

Adapted Route

Ball Milling
~4 h

New Route





Fraunhofer ILT

Laser Synthesis Processing
~1 h

Time for Mixing

Flowability of Powder

Introduction

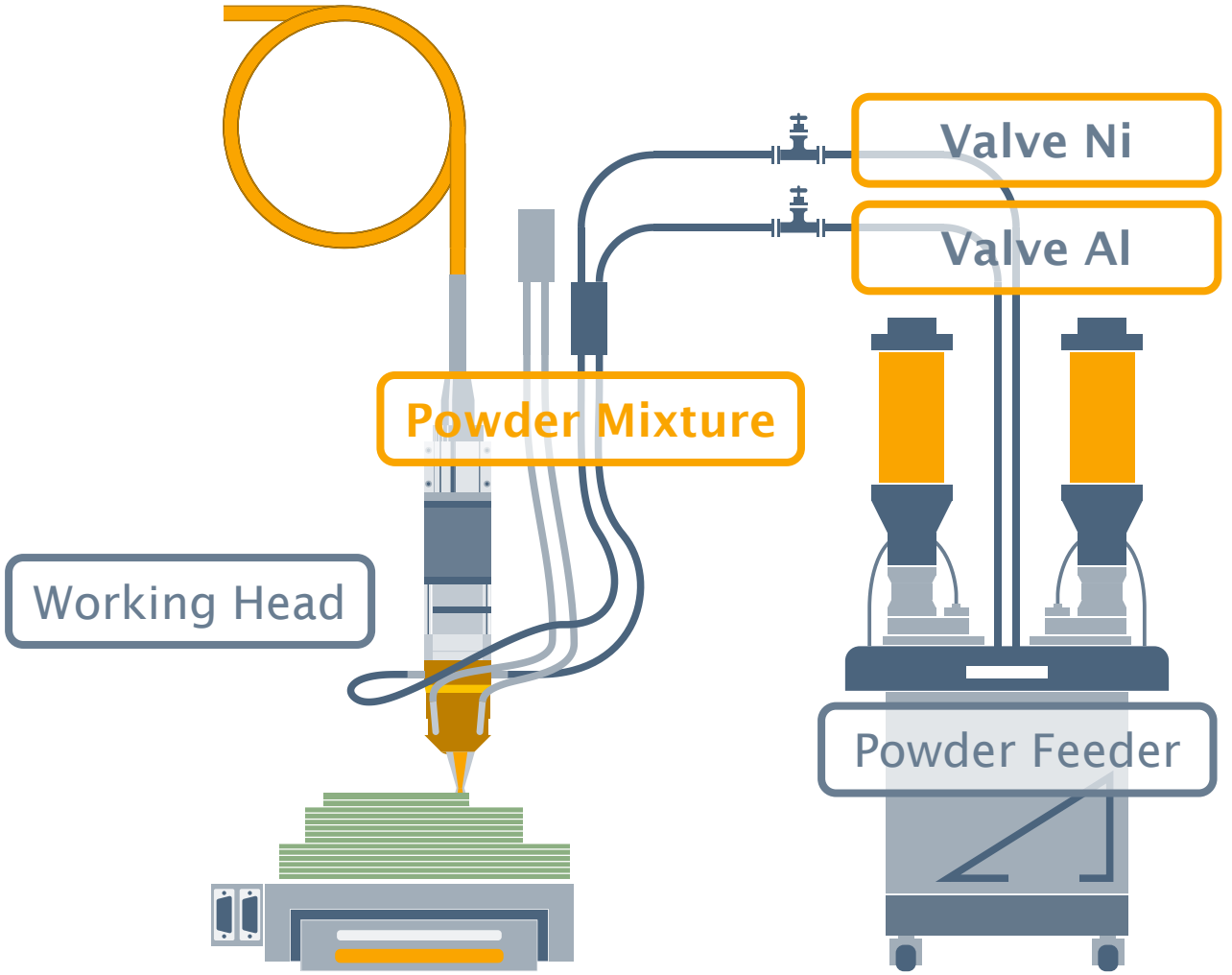
Scalmalloy®

- Aluminium-Magnesium-Scandium-Legierung
- Dichte 2,67 g/cm³
- Zugfestigkeit 520 Mpa
- Bruchdehnung 13%

Rapid Alloying by LDMD

Idea | In-Situ Metal Alloying

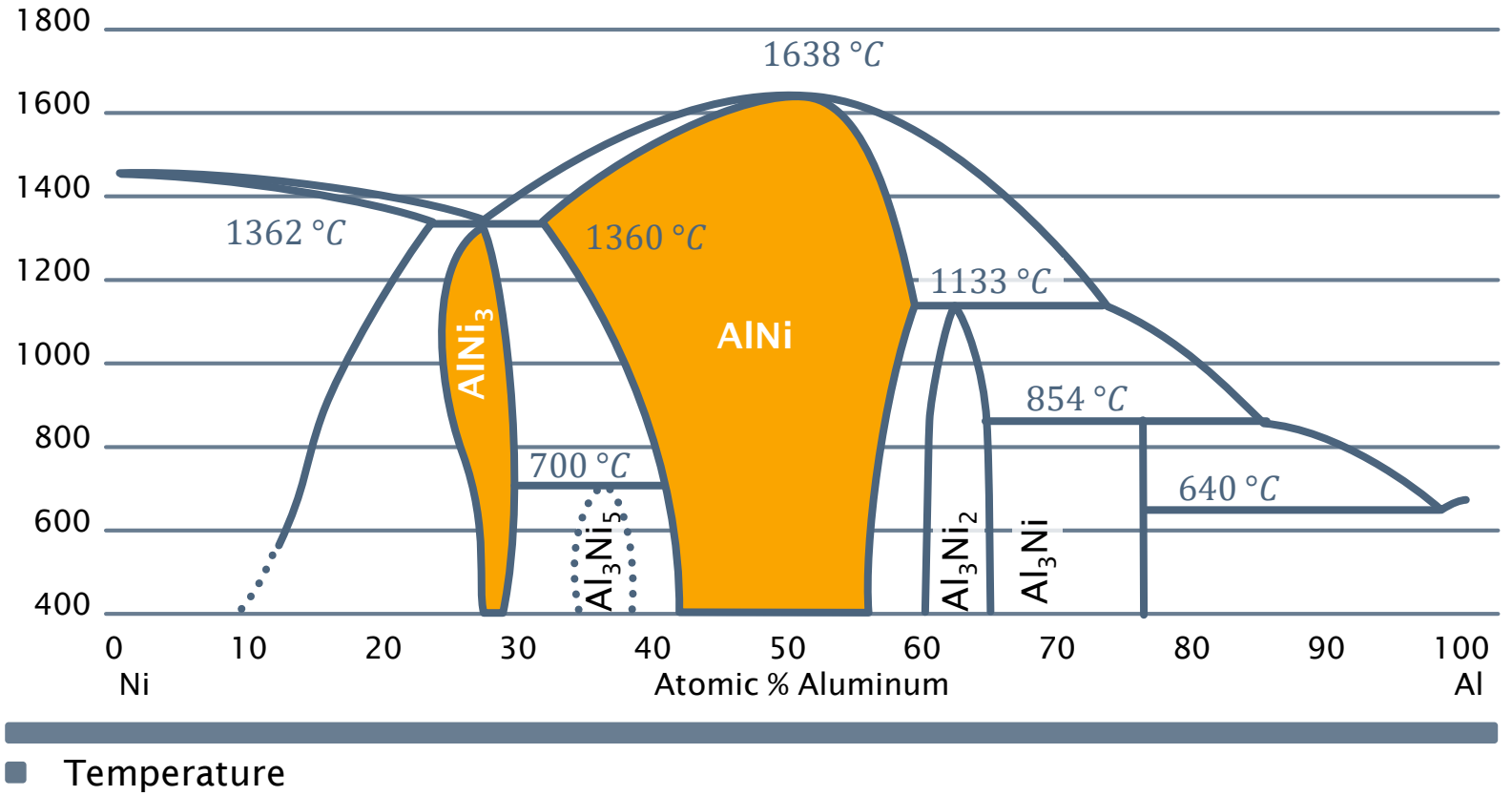
- Generation of alloy composition
  by adjusting powder ratio
  of Aluminum and Nickel
  during LDMD process
- Gradient Materials
- Adaption to
  - base plate material
  - part geometry



Rapid Alloying by LDMD

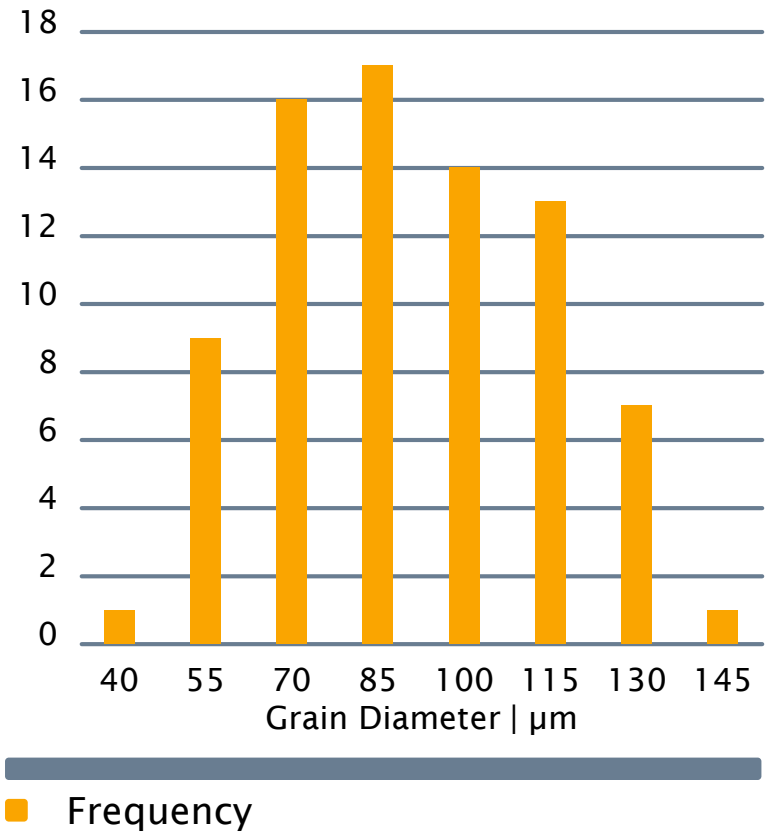
Objectives

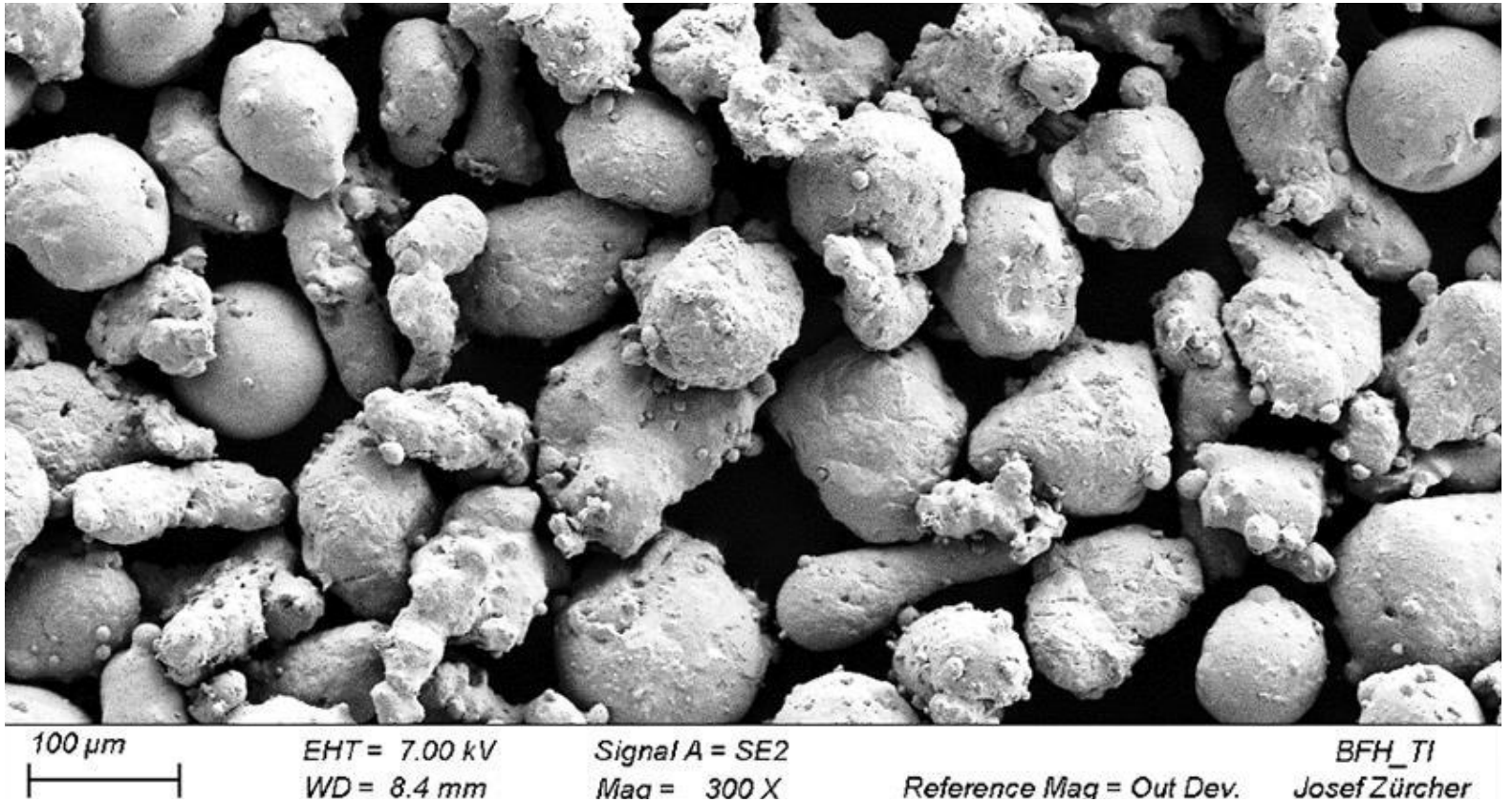
- Phase Diagramme Nickel-Aluminum



Rapid Alloying by LDMD

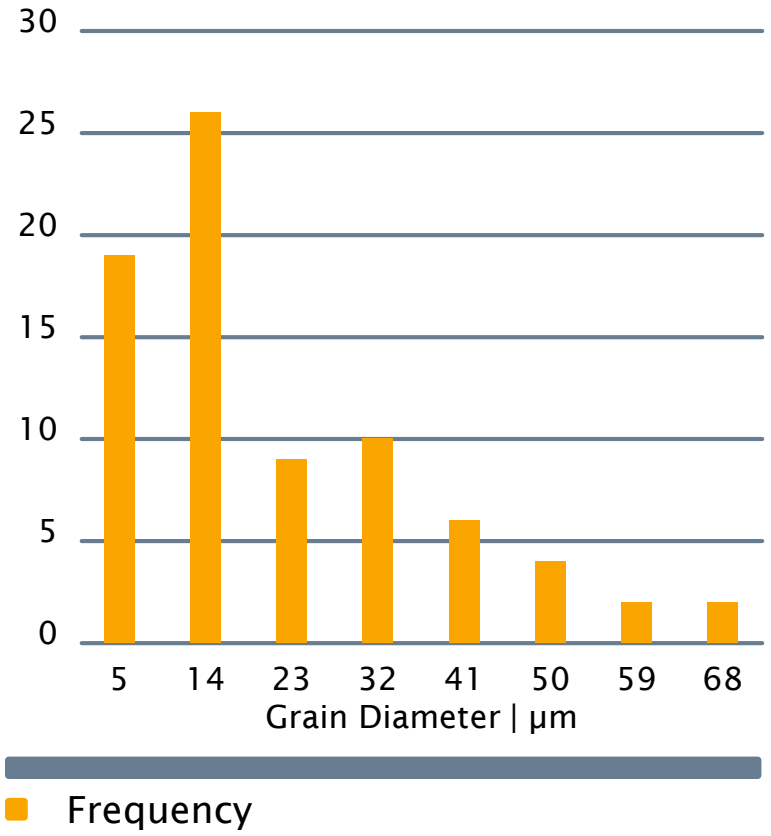
Nickel-Powder CNPC-Ni 100-300

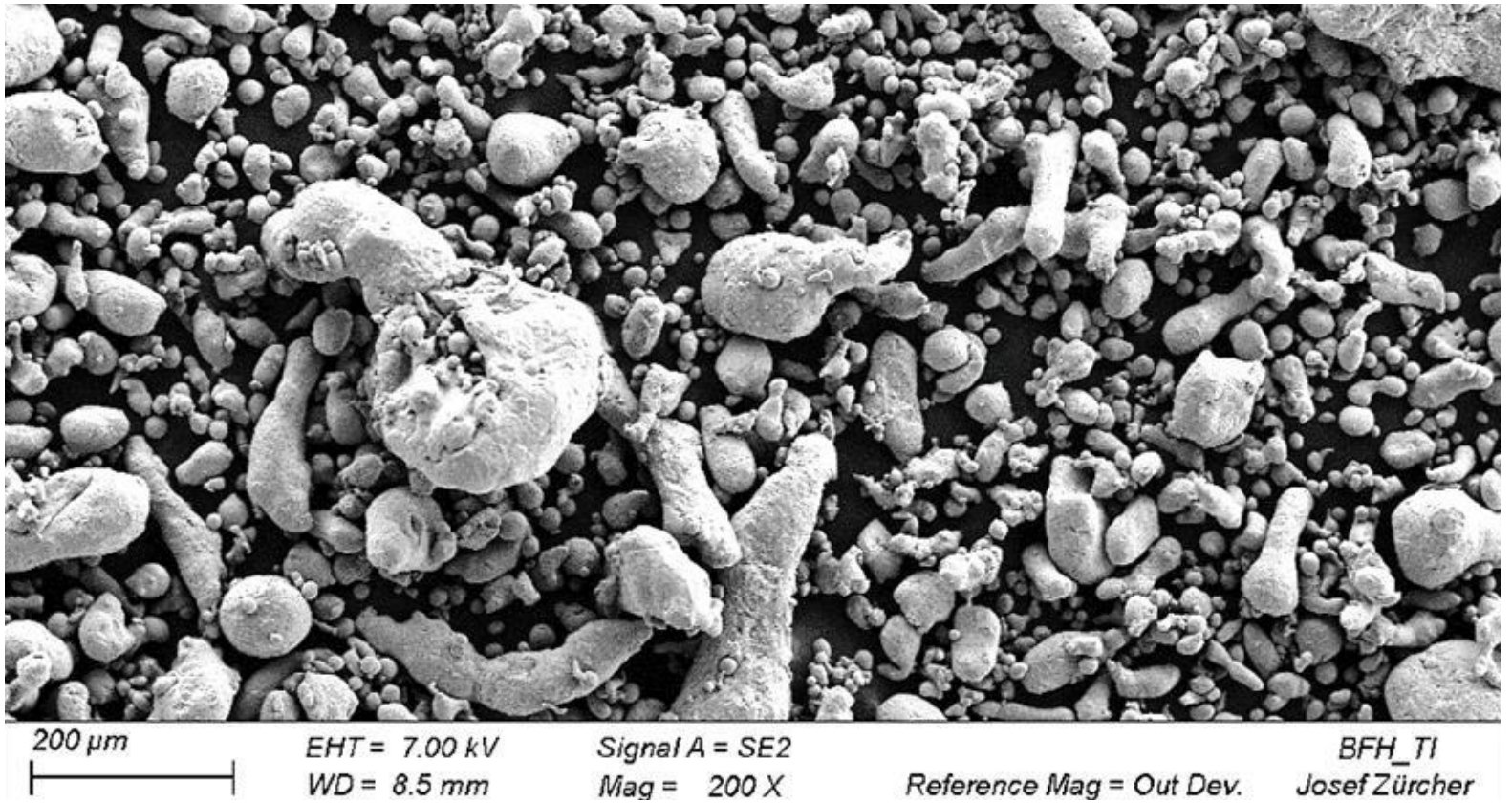




Rapid Alloying by LDMD

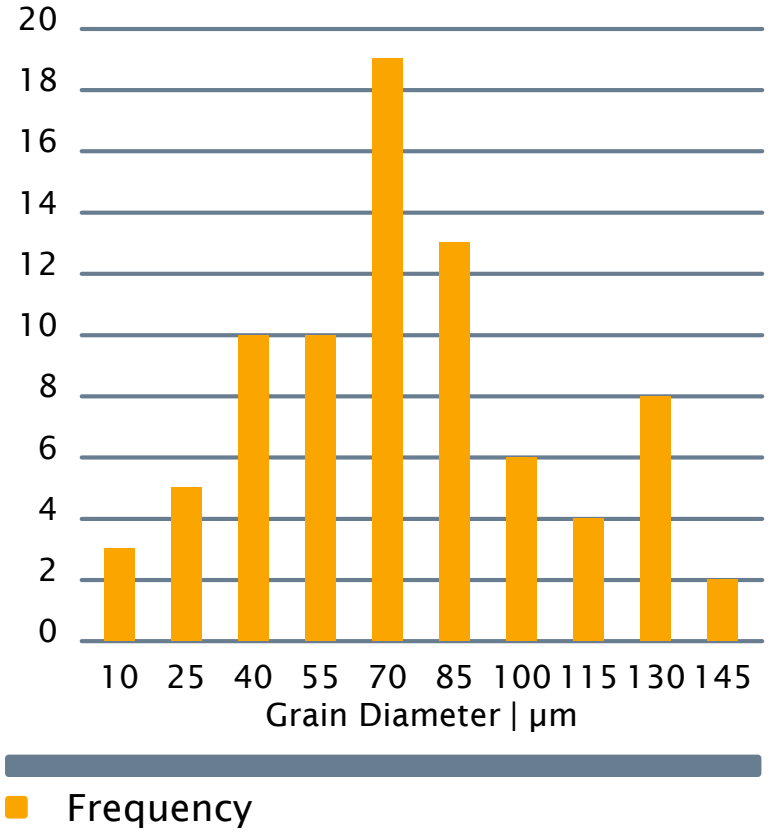
Aluminum-Powder 60 HPS

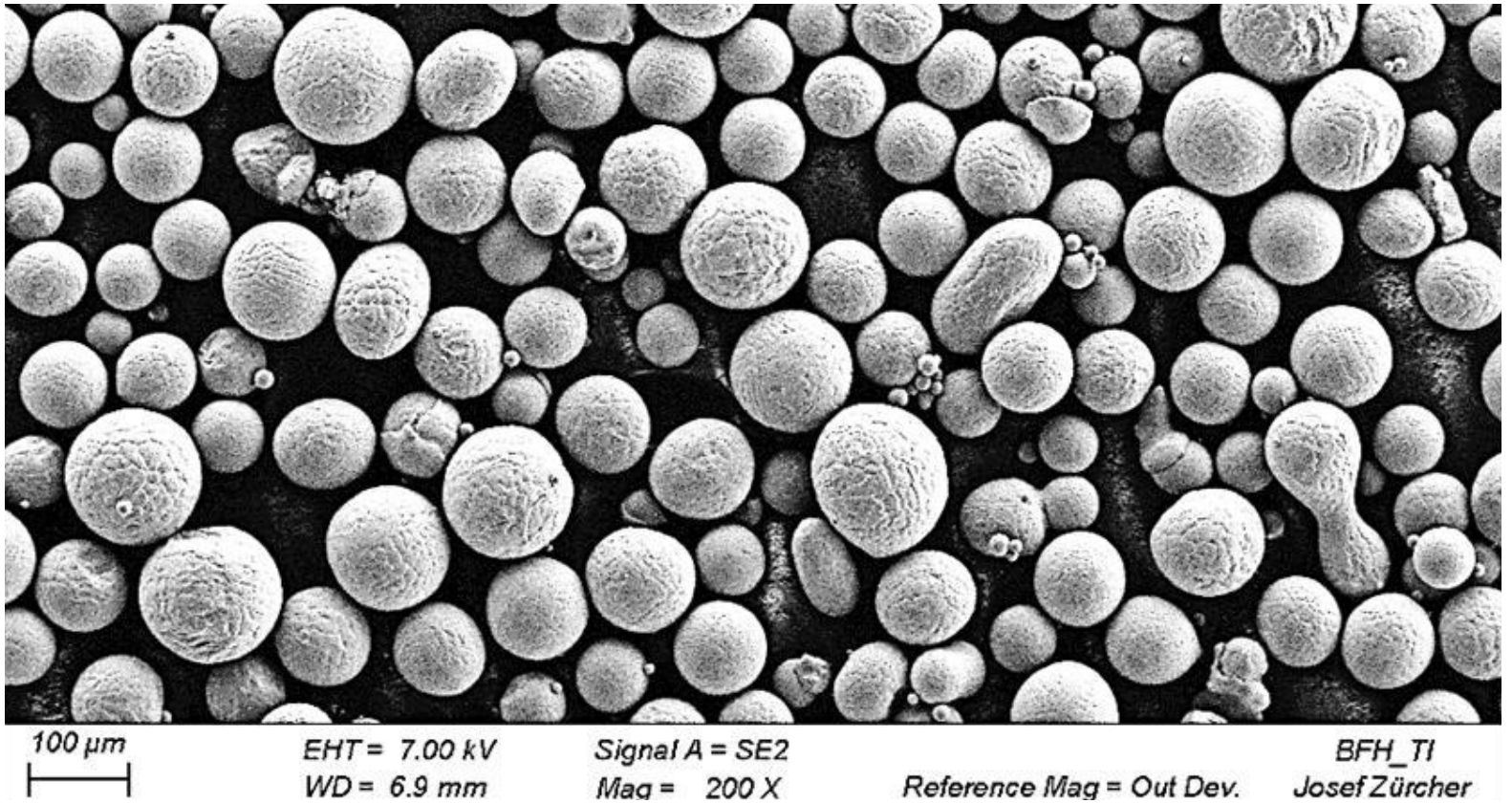




Rapid Alloying by LDMD

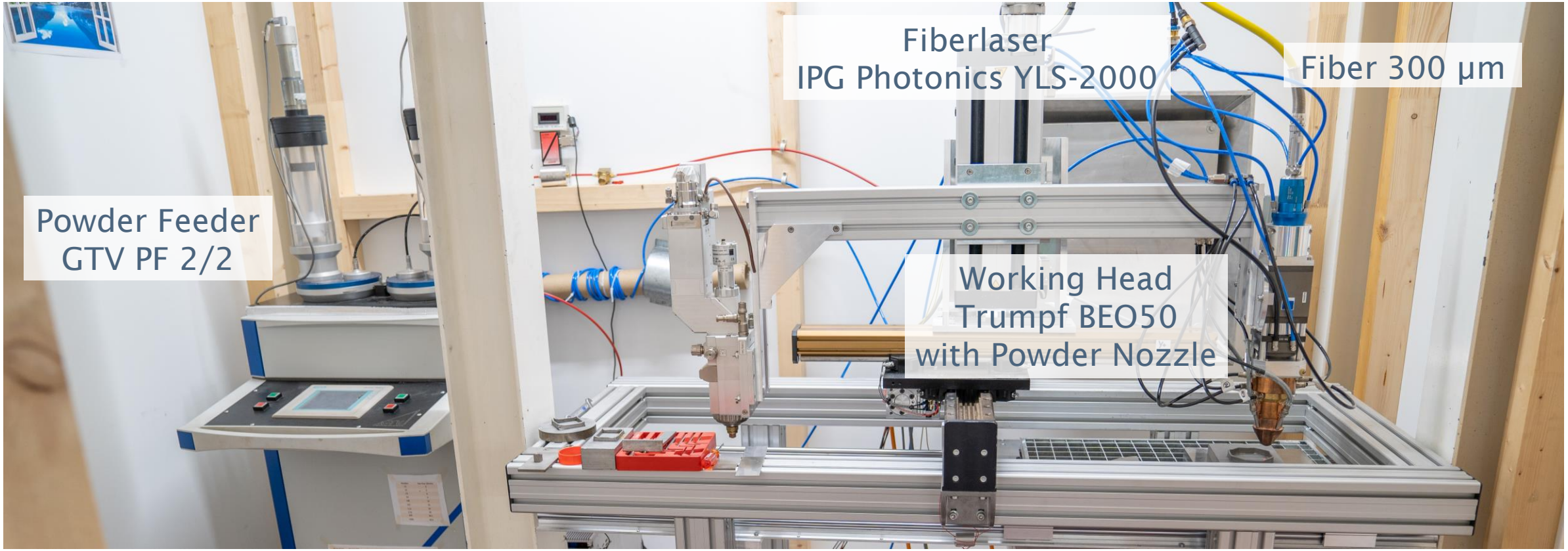
Aluminum-Powder Toyo Aluminum K.K. A1070-80BB





Rapid Alloying by LDMD

Experimental Setup

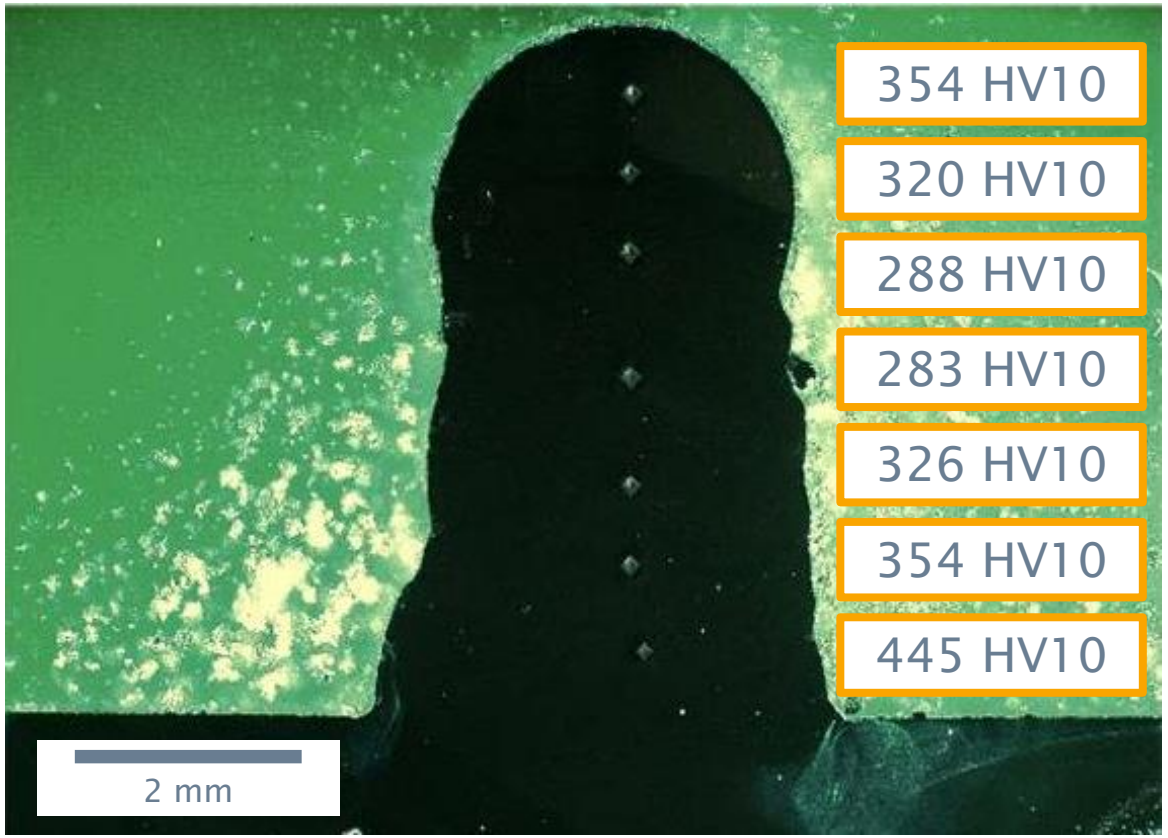


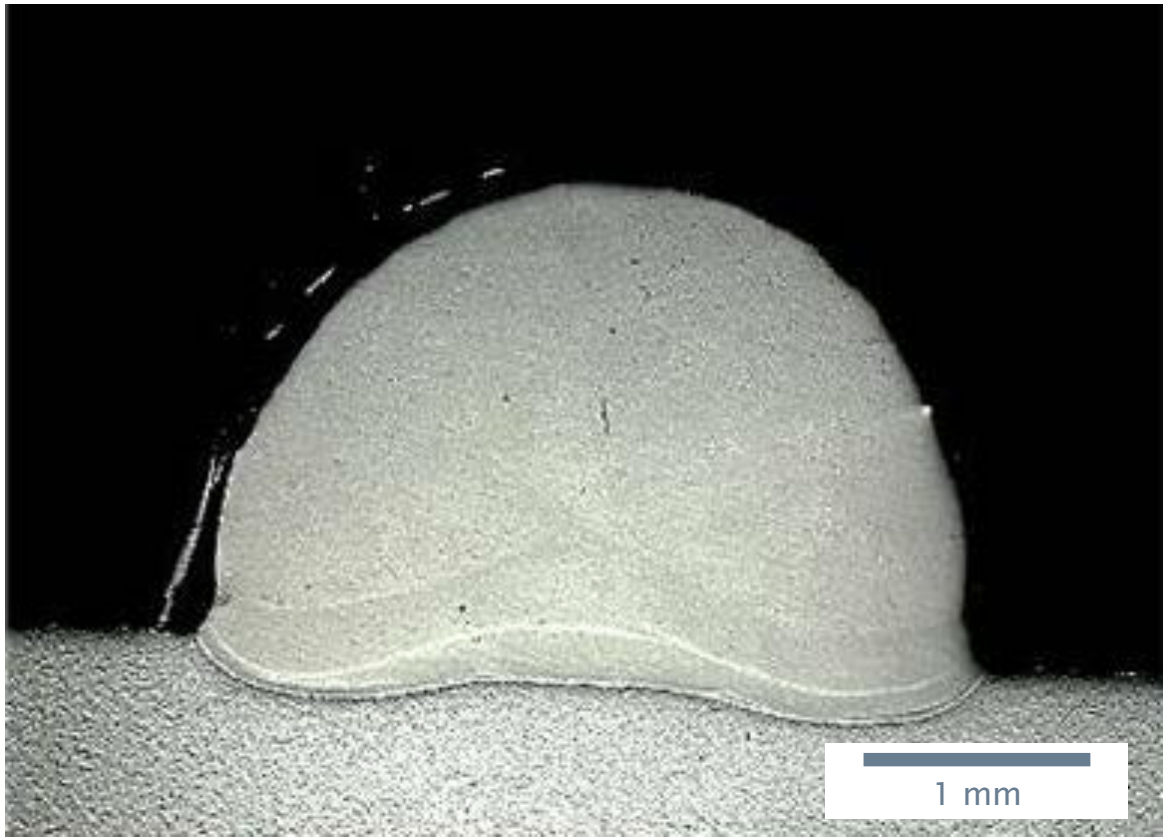
Rapid Alloying by LDMD

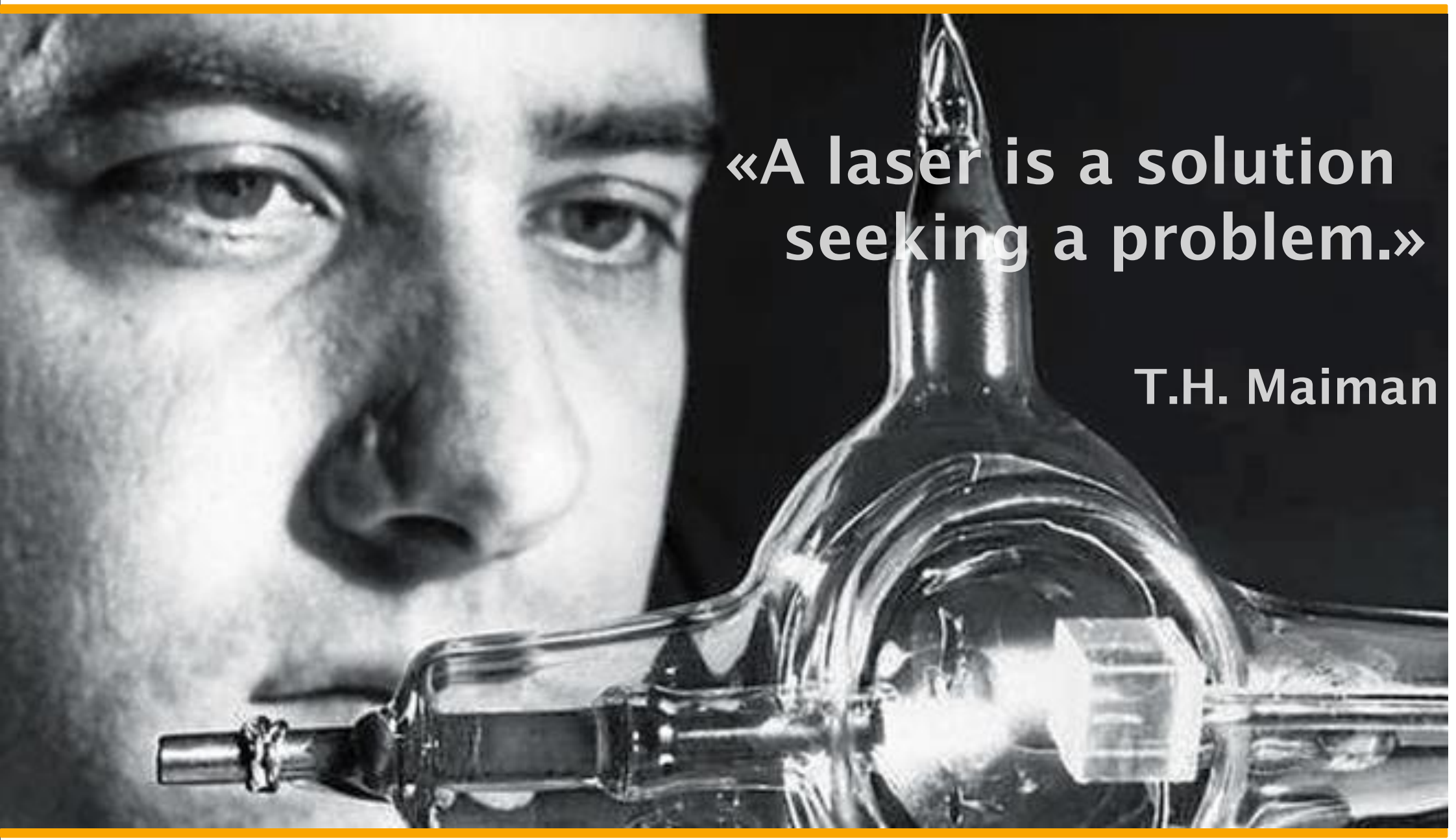
Preliminary Results $AlNi_3$

Rapid Alloying by LDMD

Preliminary Results $AlNi_3$






«A laser is a solution
seeking a problem.»
T.H. Maiman

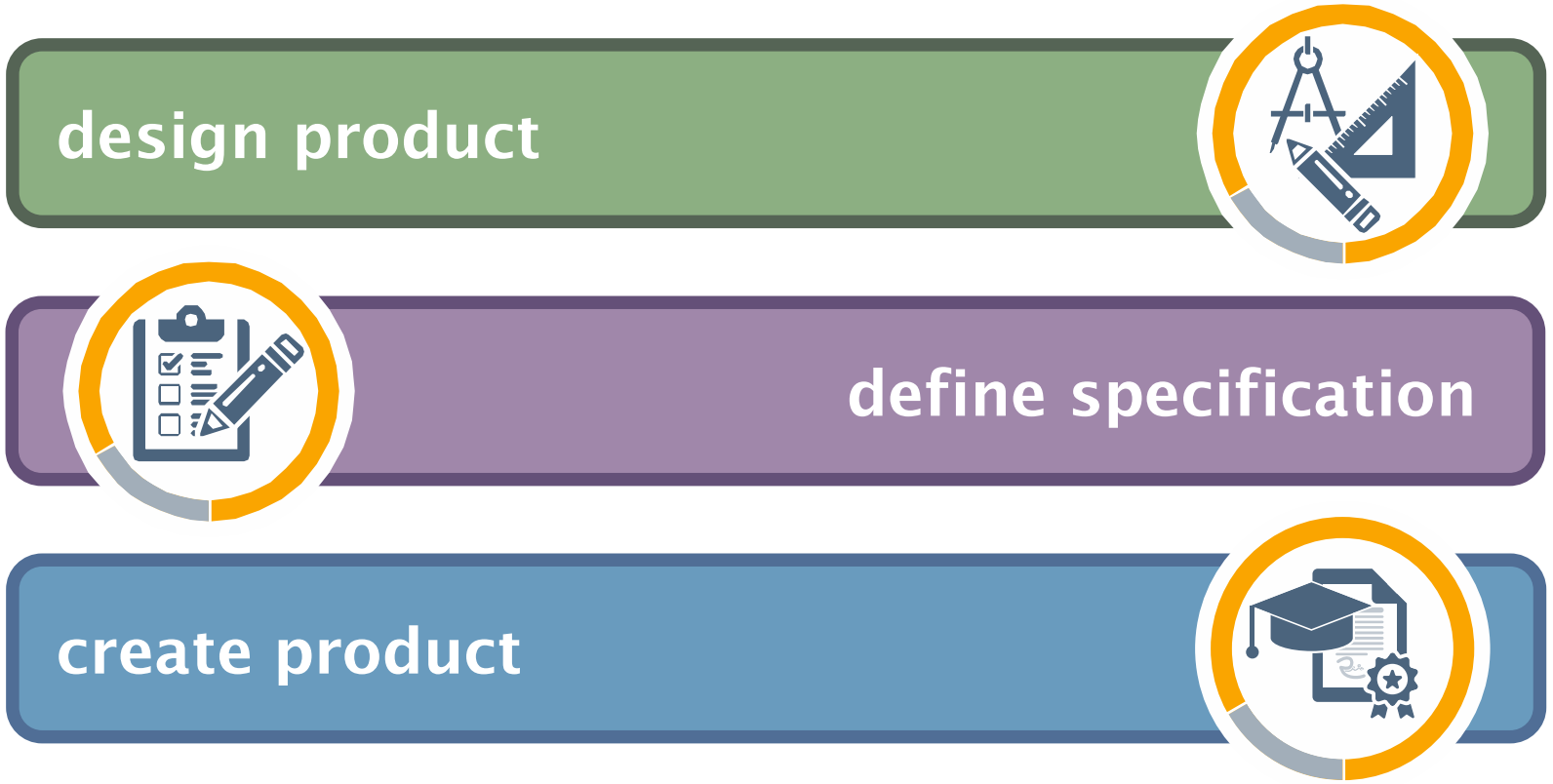
Rapid Alloying by LDMD

Providing Solutions

Define Specification and Characteristics locally

- Density
- Yield Strength
- Ductility
- Microstructure
- Gradient

according to requirements



«To make an end is to make a beginning.»

T.S. Eliot

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