



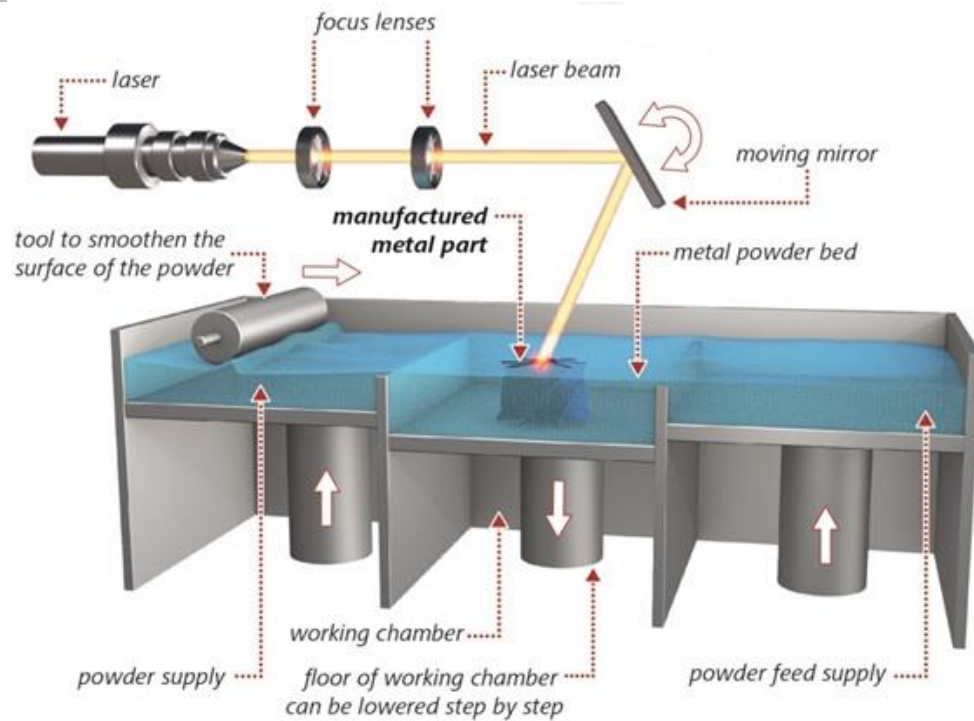
1. Visualization and analysis of ultrafast tomography performed during the laser 3D printing of ceramics.

2. Optimization of laser parameters for laser based 3D printing of ODS metals.



Malgorzata Makowska

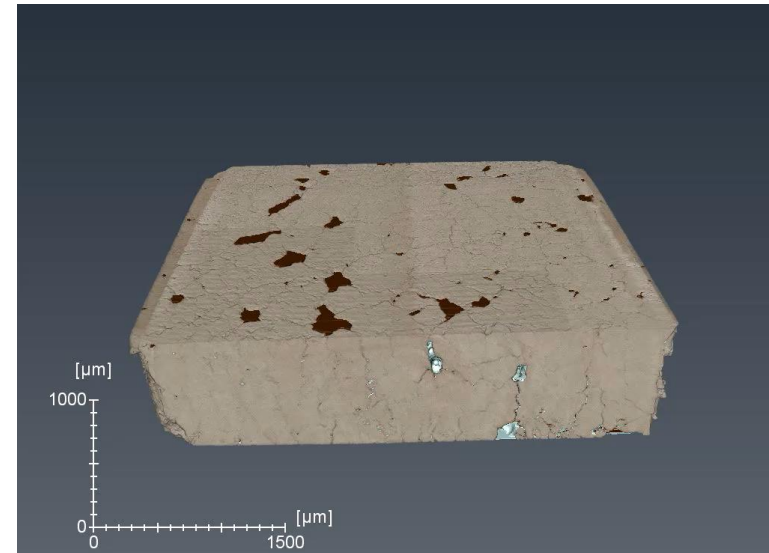
# Selective laser melting of metals and ceramics



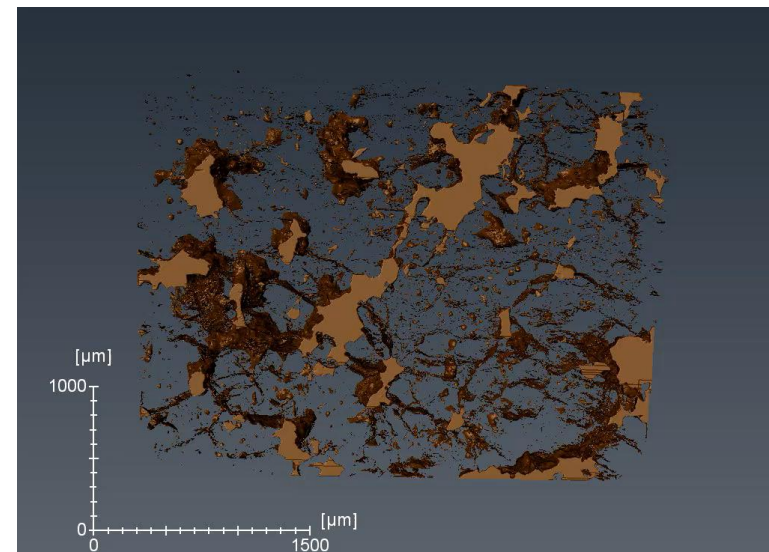
<https://scanandmake.com/additive-manufacturing>

Defects in 3D printed alumina observed with tomographic microscopy

Cracks in alumina

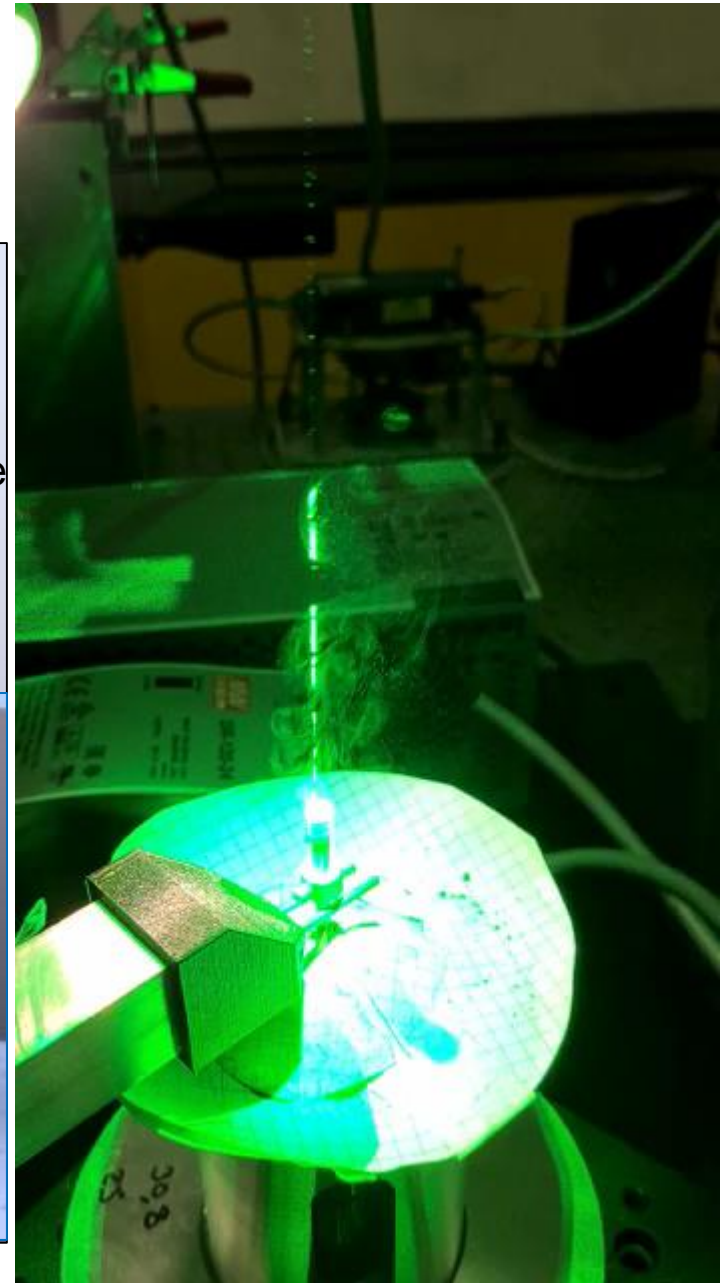
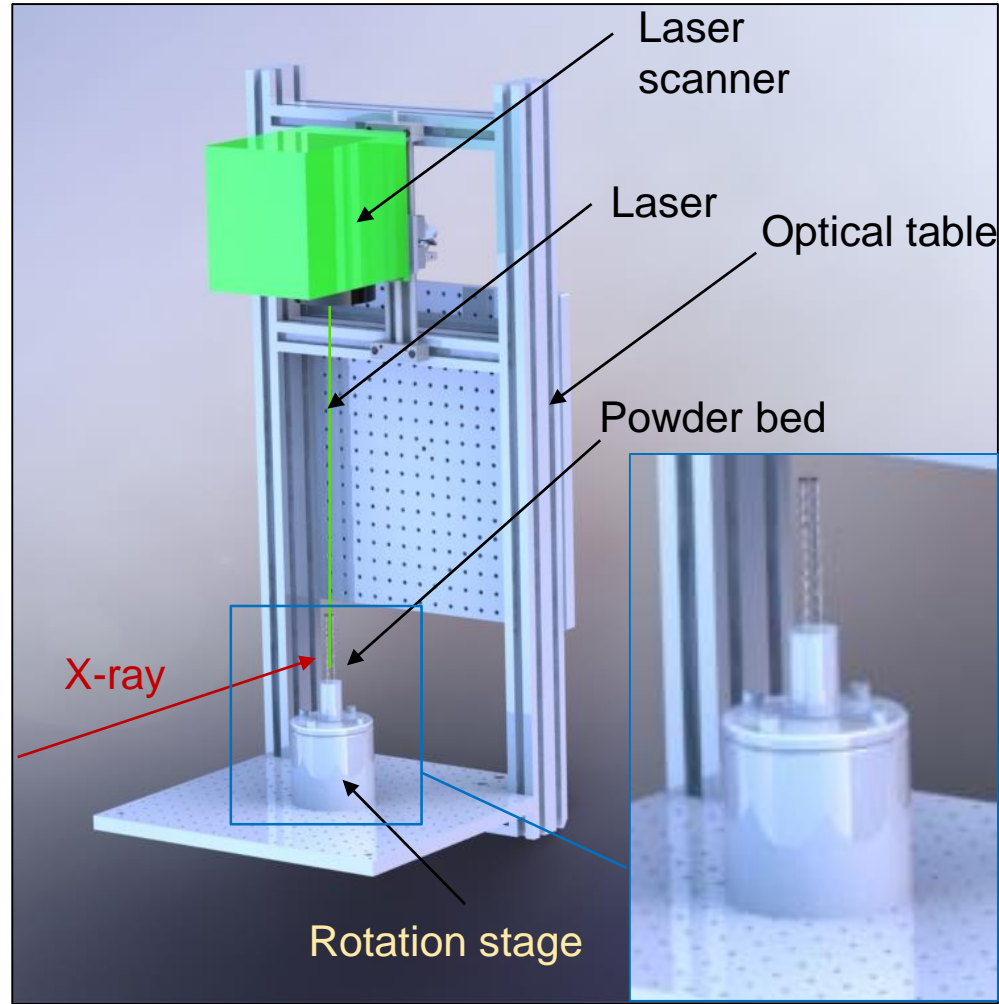


porosity



# Operando tomography of 3D laser printing of ceramics

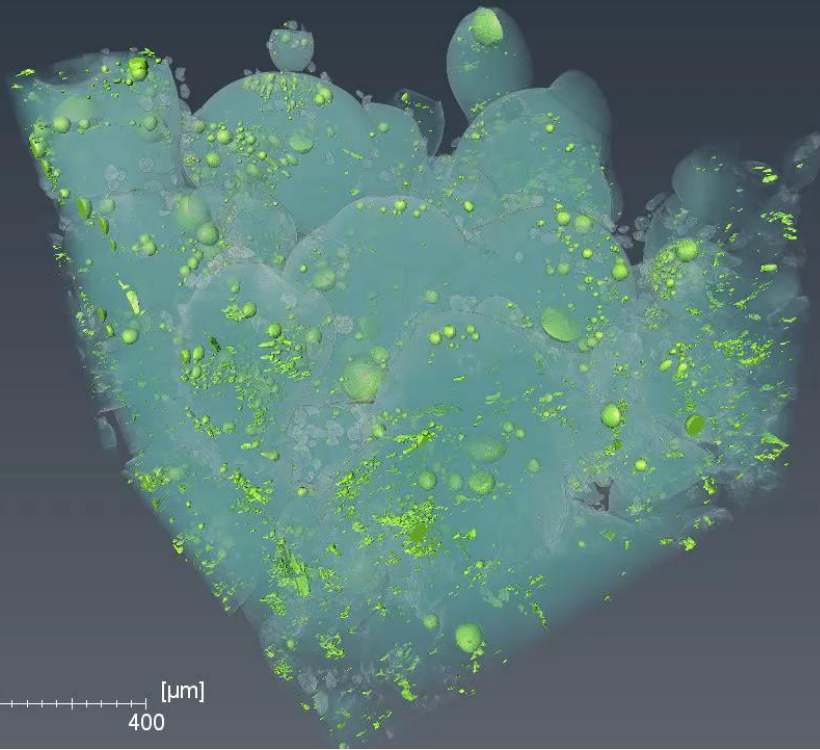
3D printing during spinning 3000 rpm



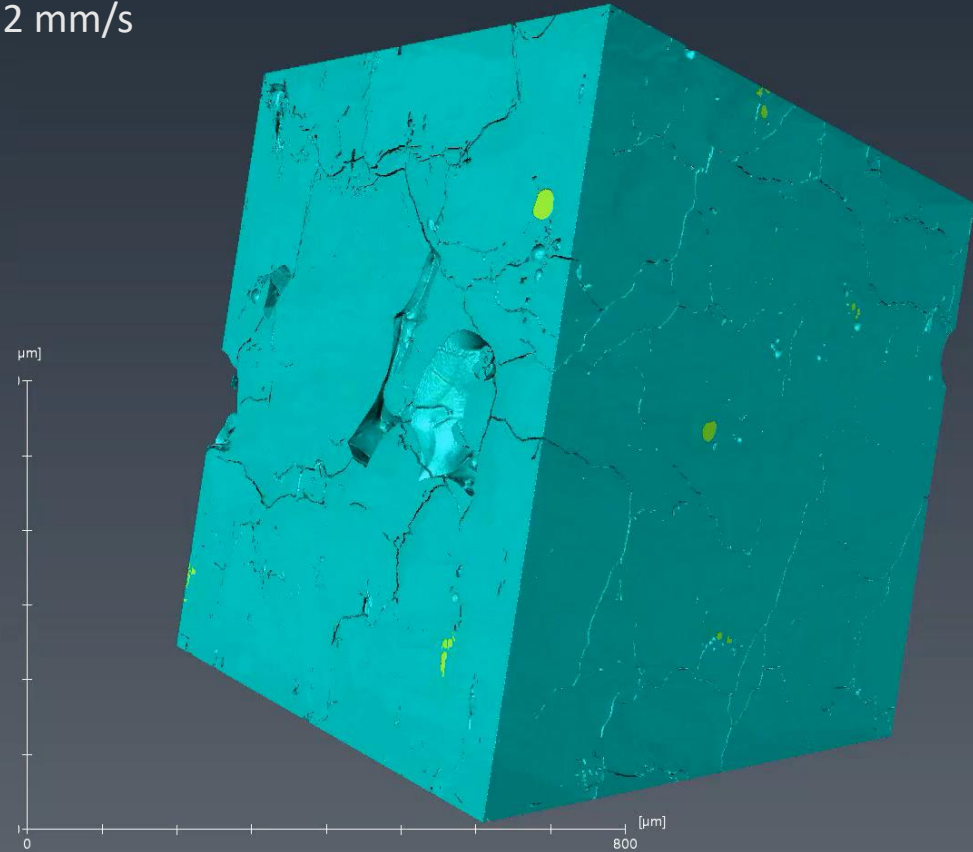
# Quantitative analysis of the formation of cracks and porosity after printing ceramics

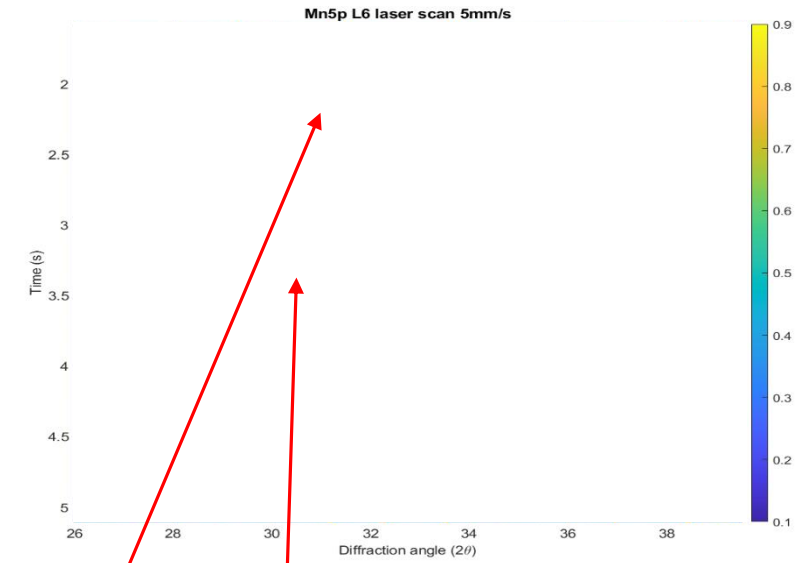
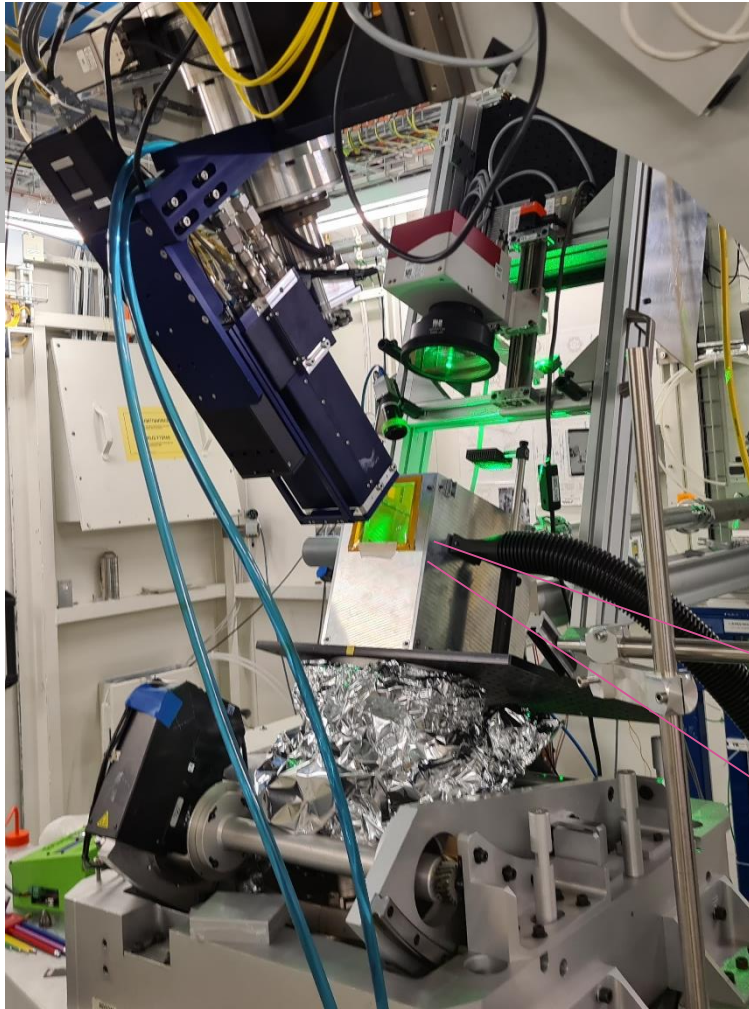
Visualization of pores and cracks in 3D printed alumina for different laser scanning speeds

10 mm/s

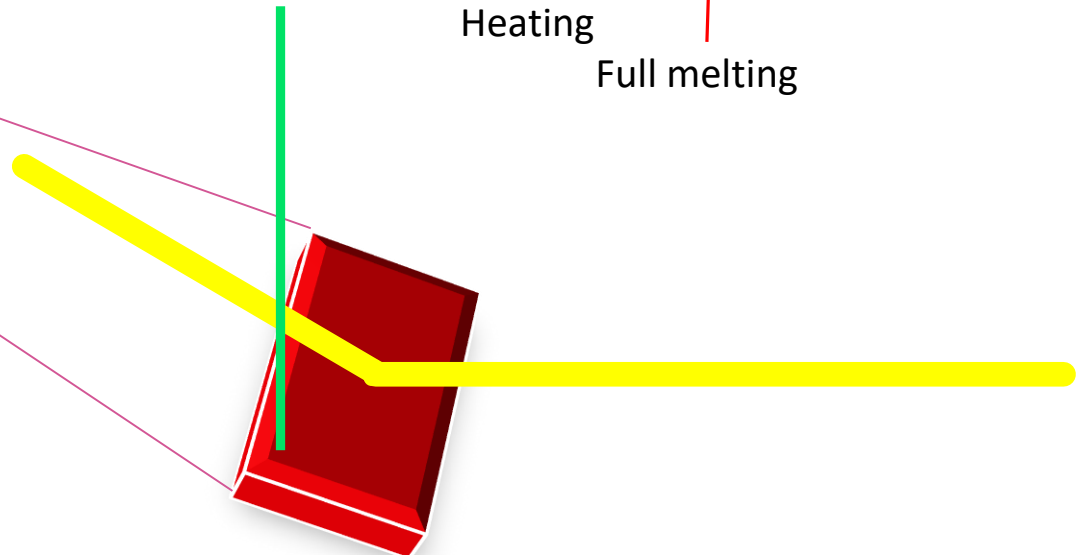


2 mm/s





Heating  
Full melting



## Proposed master projects:

### **Visualization and analysis of ultrafast tomography performed during the laser 3D printing of ceramics.**

#### TASKS:

- Learning tools (software) for image analysis (ImageJ, Avizo)
- Quantitative analysis of the formation of cracks and porosity during printing of ceramics

### **Optimization of laser parameters for laser based 3D printing of ODS metals.**

#### TASKS:

- parametrical study on the effect of laser power, laser scanning speed, powder layer thickness on the quality of printed parts
- analysis (microscopy, XRD)



# Contact

Paul Scherrer Institut

*Malgorzata Grazyna Makowska*

E-Mail: [malgorzata.makowska@psi.ch](mailto:malgorzata.makowska@psi.ch)

Telefon: +41 56 310 45 36