Additive Manufacturing of Metals and Alloys

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Cursus  
Advanced Manufacturing  
Materials Science and Engineering  

Sem.  
Type  
Obl.  
Opt.  

Language  
English  

Credits  
2  

Session  
Exam  
Oral presentation  

Workload  
60h  

Hours  
28  

Lecture  
28  

Number of positions  

Frequency  
Every 2 years  

Remark  
Next time Spring 2023  

Summary  
This course is designed to cover a number of materials science aspects related to the field of additive manufacturing of metals and alloys, and to provide an in-depth review of corresponding fundamentals.

Content  
1. Introduction to Additive Manufacturing (AM) of metals and AM methods (LPBF, EBM, DED, other methods such as binder jetting)
2. Powder fabrication and characterization
3. Interaction between beam (laser, e-beam) and material, heat formation and heat flow in the material
4. Fundamentals of rapid solidification of metals and alloys
5. Microstructure formation and control during AM
6. Residual stresses and warpage, defects (porosity, cracks) in AM parts
7. Post-treatments and associated microstructure evolutions
8. Mechanical properties of AM parts (static, cyclic), mechanical anisotropy
9. Material specific considerations: AM of steels, Ni alloys, Ti alloys, Al alloys; AM of precious metals and Cu alloys; AM of special materials (MMCs, gradient materials/multimaterials); Development/optimization of alloys

Keywords  
metals and alloys, laser processing, electron beam melting, solidification, microstructure, post-treatment, mechanical properties, residual stresses

Learning Prerequisites  
Required courses  
Participants should be educated in materials science and engineering, physics, mechanical engineering or physical chemistry to benefit the most from this course.
Assessment methods
Oral presentation

Resources
Moodle Link
• https://go.epfl.ch/MSE-666