Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

advanced manufacturing laboratory | ETHzürich

3D structures by spark plasma sintering for efficient tool manufacturing

Bachelor / Semester / Master Thesis

The **Advanced Manufacturing Lab (am|z)** performs internationally leading research in the field of manufacturing engineering. A recent research focus is put on sustainable manufacturing and low-waste production. Near-net shaping of hard materials could benefit the tool making industry to become more sustainable. For a new industry related research project, we are looking for a motivated student.

Motivation

Hard materials shape the world. Tools for many manufacturing processes require high wear resistance and toughness. Consequently, such materials are intrinsically difficult to shape themselves. Today, these tools are cut from monolithic blocks, e.g., via spark erosion and grinding. The materials of interest are manufactured via powder metallurgy (PM), but most additive manufacturing methods are unsuitable because a) they work via the liquid phase (like e.g., laser powder bed fusion LPBF), or b) they yield porous bodies. Near-net shape methods involve processes like hot-isostatic pressing (HIP).
We aim to reduce manufacturing costs and waste by pre-shaping the partly finished components in a sintering process. For this purpose, spark plasma sintering (SPS) will be employed. This sintering technique usually yields cylindric semifinished parts that need to be further processed. In this project, you will work with space holders for pre-shaping sintered PM specimen, manufactured by, e.g., binder jetting, thus making the first steps towards developing a reproducible, near-net-shape 3D sintering process.

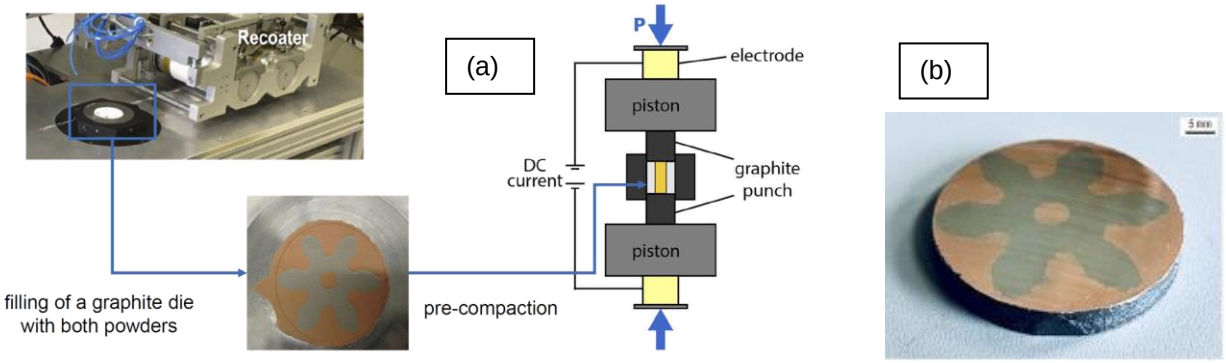

Fig 1: (a) Die-filling via selective powder deposition and SPS scheme, (b) SPSed multi-material specimen

Tasks (to be scaled to the type of project and student background)

- Literature review of 3D SPS methods and materials
- Specimen production using a spark plasma sintering machine at am|z
- Specimen analysis (microstructure, density)
- Property determination (tensile strength, hardness, wear)
- Written report and presentations (interim and final)

Peripherals

Interest in circular economy, materials science and analysis, and advanced manufacturing is required. A hands-on and experimental attitude is needed. No specific knowledge with manufacturing systems is necessary.

Start

immediately or upon agreement

Contact

Please send your resume/CV (including lists of relevant publications/projects) and transcript of records to:

Konrad Papis PFA H44 044 633 79 68 papis@inspire.ethz.ch

05.07.2022