Master – Thesis

Investigation on solid-state layer deposition (SSLD) process for dissimilar aluminium-steel compounds

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

Helmholtz-Zentrum Geesthacht, Institute of Materials Research, Solid State Joining Processes

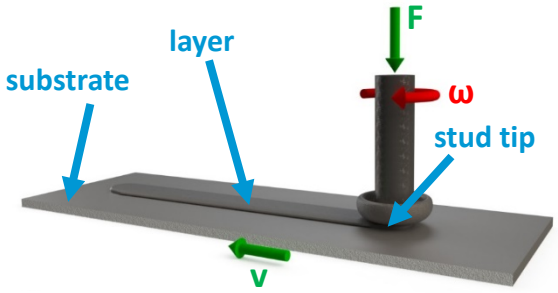
Scope of Work

Previous generative production processes include the so-called powder bed fusion processes (e.g. Selective Laser Sintering, SLS), material extrusion processes (e.g. Fused Deposition Modeling, FDM) or vat photo polymerization (e.g. Digital Light Processing, DLP). Within the scope of our scientific roadmap, you will examine the friction surfacing (FS) based solid state layer deposition (SSLD) process as a future generative production method for dissimilar materials. The particular advantage of this technology is that the resulting materials are not mixed with one another. As a result, material combinations are possible, which cannot be joined by fusion welding.

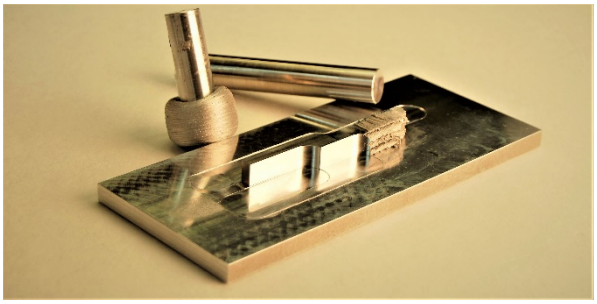
Your work comprises of friction surfacing (FS) aluminium alloys on steels and investigating ways of potentially increasing the layer to substrate bonding strength for the subsequent SSLD process. This includes the preparation of the materials and tools, the set-up of the welding machine as well as the subsequent evaluation of the recorded data (e.g. process forces, process temperatures, etc.).

Furthermore, you will carry out evaluations of the modified material areas by means of metallographic characterisation as well as micro hardness tests. Selected welds will be further characterised by e.g. micro hardness mappings, micro-flat transverse tensile tests, as well as peel and/or cross tension tests, to determine their mechanical and technological properties.

The place of employment would be the Helmholtz-Zentrum Geesthacht.



Schematic of the friction surfacing (FS) process. Axial force (F) and rotational speed (ω) plasticise the stud tip. A translational movement (v) is superimposed and a layer deposited on to the substrate surface. At the end the used stud is retracted from the substrate.
Source: HZG.



Demonstrator for the solid state layer deposition (SSLD) process showing multiple layers in as welded (right) and machined (middle and left) condition with used (background left) as well as unused (background right) friction surfacing studs.
Source: HZG.

Tasks

- Literature research (e.g. materials, joining processes, intermetallic phases, dissimilar joints, surface activation).
- Development of the experimental design and execution of the desired experiments including data acquisition as well as mechanical and metallographic characterisation.
- Evaluation and presentation of the results as well as documentation of the experimental work (in English or in German).

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