

Introduction

Refill Friction Stir Spot Welding (refill FSSW) is a solid-state technology which is capable of joining two or more materials in a spot-like lap joint configuration. Due to its advantages such as solid-state welding, less energy consumption, compatible with dissimilar materials, and superior mechanical properties for the resultant joints, the process is especially applicable to difficult-to-weld and non-weldable alloys, e.g., lightweight alloys that widely used in the automotive as well as the aircraft and aerospace industries. In this areas, therefore, Refill FSSW is considered as a potential alternative to mechanical fastening and resistance spot welding.

The aim of this thesis is to determine an optimal joint configuration for multi-spot welds of Refill FSSW for quasi-static and dynamic loading condition and also develop basic knowledge of structural behavior Refill FSSW (stress analysis, secondary bending, fatigue stress analysis).

More detail, the project begins with optimization of the refill FSSW for welding high strength Al alloys with application of the adhesive sealant in between the sheets, the geometrical variable such as number of spot welds, distance between the spots, distance of the spot welds from the sheet edge, will be optimized with the objective to optimize the quasi-static and dynamic properties of the coupons/panels.

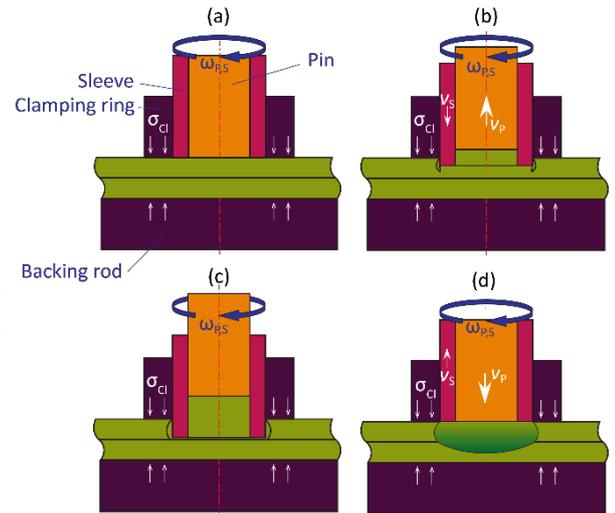
The place of employment would be in Geesthacht at Helmholtz-Zentrum Geesthacht.

Tasks

- Literature research of refill FSSW and mechanical testing analysis.
- Metallurgical preparations and analysis of resulting welded specimens.
- Development of the experimental design and execution of the desired experiments including welding experiments, tensile tests and fatigue test experiments.
- Presentation of the results and documentation of the experimental work (in English).
- Optional: numerical analysis of the structure behaviour of the multi-spot welds during loading.

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The principle of refill FSSW process. First, the clamping ring holds the materials. Then, the sleeve rotates and plunges into the material, while the rotating pin simultaneously moves upward. Afterward, the rotating sleeve and pin return to their initial positions, resulting in a keyhole-free joint.



Aircraft demonstrator produced by using friction-based welding, including Refill FSSW

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