

## Friction Stir Welding (FSW)

Friction Stir Welding (FSW) is a simple, clean and innovative joining technology for light metals invented by TWI, England. Due to the high strength of FSW joints, it allows considerable weight savings in lightweight construction compared to conventional joining technologies.

- Low energy consumption
- Low shrinkage
- No filler wire
- Simple preparation of the weld seam
- Good mechanical reproducibility
- No welder certification required

### Process principle:

In friction stir welding a rotating pin emerging from a cylindrical shoulder is plunged between two pieces of sheet and moved forward along the joint line. The material is heated by friction between the rotating shoulder and the workpiece surface and simultaneously stirred by the profiled pin leaving a solid phase bond between the two pieces to be joined. Special preparation of the weld seam and filler wires is not required.

### What DLR offers:

In 1997 the Institute of Materials Research of the German Aerospace Center, DLR, was the first non-industrial research institute in Germany working in the field of friction stir welding of aluminium alloys and one of the first TWI licensees in Germany. The FSW is performed on a very stiff, numerically controlled bedplate milling machine. The process is checked by online temperature, displacement and force measurement.

Besides manufacturing of FSW specimens and components with optimised process parameters, DLR also offers the complete characterisation of the weld seam.

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### Process Advantages:

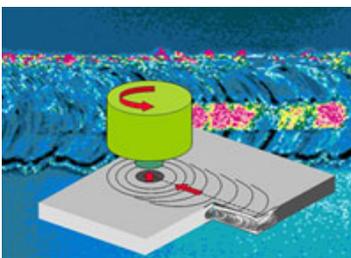
In contrast to conventional welding technologies, the FSW process takes place in the solid phase below the melting point of the metals to be joined. Thus, all the problems related to the solidification of a fused material are avoided. Materials classified as difficult to fusion weld like the high strength aluminium alloys used in the aerospace industry could be joined with minor loss in strength.

The small-scale industry can especially benefit from the low investment costs of the mechanical equipment required for Friction Stir Welding. The ability to join different aluminium and magnesium alloys offers a great variety of new products.

### Characterisation of FSW joints:

- Microstructure
- Tensile strength (local strain of different weld regions)
- Fatigue strength
- Fracture mechanical investigations, damage tolerance
- Corrosion properties
- Residual stresses
- Non-destructive testing (ultrasonic)

FSW Process



### Advantages of Friction Stir Welding:

- Temperatures well below the melting point
- Excellent tensile and fatigue strength
- No splatter, no fume

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