

FUNDAMENTALS OF THE PROCESS AND TOOLS DESIGN: FRICTION STIR PROCESSING OF MATERIALS

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ABSTRACT

Friction stir processing (FSP) is a new solid state processing technique that can locally eliminate casting defects and refine microstructures, thereby improving strength and ductility, increasing resistance to corrosion and fatigue, enhancing formability, and improving other properties. FSP can also produce fine-grained microstructures through the thickness to impart superplasticity. Essentially, FSP is a local thermomechanical metal working process that changes the local properties without influencing the properties of the bulk material.

The first part of the paper introduces the FSP fundamentals of the process and its parameters, also approaching the material flow pattern due to the deformation process and the thermal profile. The tools design diversity used for different materials, even for those having high melting temperatures as steel, stainless steel and Ni based alloys is presented. Experiments regarding the influence of the FSP main parameters (the tool rotational and advancing speed) on material flow pattern around the tool are also considered.

KEYWORDS: Friction Stir Processing, material flow, temperature, tool design.

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