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T-JOINT ON SIMILAR METALS BY USING FRICTION STIR WELDING

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ABSTRACT

Friction stir Welding (FSW) is a state of the welding technique in which a specially designed rotating tool consists of shoulder and a pin that applies the frictional force. Friction causes to produce heat on the work piece to weld two work pieces clamped together on fixture.

The investigation of joining of similar metals of Al-6082-6082 is carried out by using Friction Stir Welding (FSW). Since the aluminum alloys are difficult to weld; friction stir welding is extensively used in joining of similar aluminum alloys. The tool used in this welding is EN-19.

After the welding operation is done microstructure analysis and radiography tests will be carried out. The microstructure study will indicate the spread out of materials mixing between two materials at both side of the welding zone. Radiography test is done to show that there are no defects observed in the welded material. In this investigation an attempt will be made to study the effect of tool pin profiles and welding parameters on the formation of friction stir weld in Al6082 alloy

Keywords: Friction stir welding, Aluminum, EN19 tools of taper Square profiles, microstructure and radiography

INTRODUCTION

Friction stir welding (FSW) is a solid-state joining process that uses a non-consumable tool to join two facing work pieces without melting the work piece material. Heat is generated by friction between the rotating tool and the work piece material, which leads to a softened region near the FSW tool. While the tool is traversed along the joint line, it mechanically intermixes the two pieces of metal, and forges the hot and softened metal by the mechanical pressure, which is applied by the tool, much like joining clay, or dough. It is primarily used on wrought or extruded aluminum and particularly for structures which need very high weld strength. FSW is also found in modern shipbuilding, trains, and aerospace applications.

It was invented and experimentally proven at The Welding Institute (TWI) in the UK in December 1991.In late 1991 a very novel and potentially world beating welding method was conceived at TWI. The process was duly named friction stir welding (FSW), and TWI filed for worldwide

patent protection in December of that year. TWI (The Welding Institute) is a world-famous institute in the UK that specializes in materials joining technology. Consistent with the more conventional methods of friction welding, which have been practiced since the early 1950s, the weld is made in the solid phase, that is, no melting is involved. Compared to conventional friction welding, FSW uses a rotating tool to generate the necessary heat for the process.

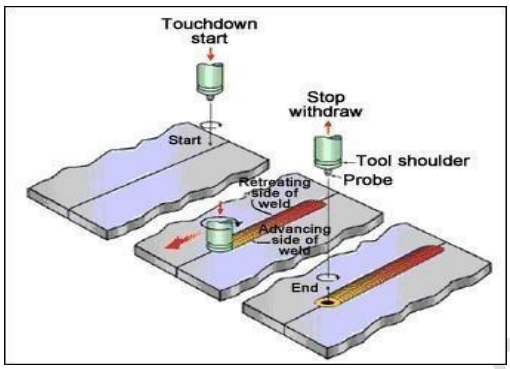

Fig 1: Friction Stir Welding

LITERATURE REVIEW

FRICTION STIR WELDING PROCESS PRINCIPLE

A rotating cylindrical tool with a profiled probe is fed into a t-joint between two clamped workpieces, until the shoulder, which has a larger diameter than the pin, touches the surface of the workpieces. The probe is slightly shorter than the weld depth required, with the tool shoulder riding atop the work surface. After a short dwell time, the tool is moved forward along the joint line at the pre-set welding speed.

Frictional heat is generated between the wear-resistant tool and the work pieces. This heat, along with that generated by the mechanical mixing process and the adiabatic heat within the material, cause the stirred materials to soften without melting. As the tool is moved forward, special profile on the probe forces plasticised material from the leading face to the rear, where the high forces assist in a forged consolidation of the weld. This process of the tool traversing along the weld line in a plasticised tubular shaft of metal results in severe solid-state deformation involving dynamic recrystallization of the base material.

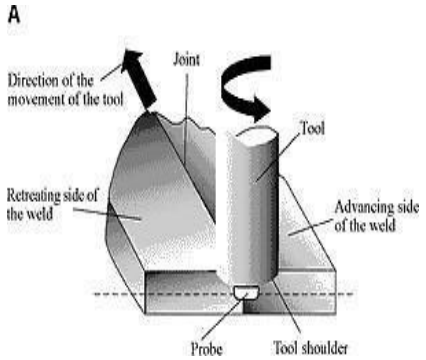

Fig: 2 Principle of Friction Stir Welding

PROCESS MATERIAL

TOOL DESIGN

The design of the tool is a critical factor

as a good tool can improve both the quality of the weld and the maximum possible welding speed. It is desirable that the tool material is sufficiently strong, tough and hard wearing, at the welding temperature.

EXPERIMENT PROCEDURE

FRICTION STIR WELDING ON VERTICAL MILLING

Fig : 3 FSW on vertical milling machine

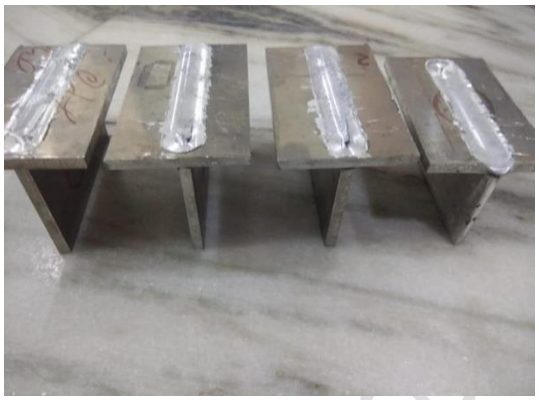

Fig:4 T-JOINT Welded plates of Aluminium

RESULTS AND DISCUSSIONS

We have conducted friction stir welding on a milling machine by using similar plates of Aluminum 6082 and by using tool EN 19, with taper square profile with a tool inclination of 0.5 and traverse speed of 710RPM,900RPM,1120RPM and 1400 RPM with feed rate of 30 mm/min and depth of cut as 2.8mm.

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