EXPERIMENTAL STUDY OF MICRO HARDNESS BY FRICTION STIR WELDING PROCESS OF AA 6061-T6

Dan Cătălin Bîrsan [1]

[1] *"Dunărea de Jos" University of Galaţi, Depart. of Manufacturing Engineering, dbirsan@ugal.ro*

Abstract: *The research has been focused on characterization of the FSW joints of AA 6061-T6 plates of 10 mm thickness were friction stir butt welded at a constant rotation speed of 1180 min^{-1} and welding speed of 2.5 mm/s. Variation of the material micro hardness measured transversely across the friction-stir weld over the top surface of the work-piece plates on both sides of the joint has been performed.*

Keywords: *FSW, hardness, aluminium alloy*

1. Introduction

Friction stir welding (FSW) is an innovative method of joining materials developed and patented by The Welding Institute in Cambridge, England. This process normally consists of three phases – the plunge stage, where ideally a non-consumable tool penetrates into the materials being joined, a dwell stage, where the tool rotates without moving in the lateral direction, and the traverse stage, where the tool moves laterally along the joint line of the materials to be welded.

FSW combines frictional heating between the tool and the work-piece with intense plastic deformation of the work-piece to create solid state joining of materials and therefore making FSW the preferred method of joining materials.

Friction stir welding of aluminum has already been widely adopted as the preferred method of welding. The applications of FSW for aluminum have created a desire to use this process for joining harder materials such as composites and steels.

High strength aluminum alloys (2xxx- and 7xxx-series alloys) that are usually employed in the aeronautic industry are normally difficult to fusion weld since dendritic structure is formed in the fusion zone when TIG and laser welding are used leading to a drastic reduction of the mechanical behavior (static and dynamic properties) [4]. As a solid-state process, FSW is capable of producing high-quality defect free welds (no solidification defects and/or brittle intermetallic phases) when optimized parameters are used.

2. Determination of Vickers microhardness. Experimental method

For the experiment, a weld seam, using friction stir welding process, has been performed, on an aluminum plate of 300x100x10 mm. The FSW weld has been performed with the following parameters:

-Welding speed v = 2.5 mm/s;

-Rotation speed ω = 1180 rpm.

The Vickers microhardness test method consists of indenting the test material with a diamond indenter, in the form of a right pyramid with a square base and an angle of 136 degrees between opposite faces subjected to a load. The full load is normally applied for 10 to 15 seconds. The two diagonals of the indentation left in the surface of the material after removal of the load are measured using a