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Experimental Investigation of Tensile Properities on FSW Aa8011

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Abstract
Friction stir welding (FSW) of 8011 aluminum alloy plates having a thickness of 4 mm is to be performed and investigated the effects of the base material conditions in the friction stir weld zone. The rotational speed of the tool made up of high carbon high chromium steel alloy is in the range of 800 – 1200RPM and its traverse speed is under a constant speed of 40&60 mm/min. After welding, the experimental results with respect to axial force, tool rotational speed and its traverse speed are to be analyzed in the friction stir weld zone and used to analyze significant effect on weld morphologies, weld defects, Tensile test and joint efficiency would also be conducted to predict the ultimate tensile strength (UTS).
Keywords: *FSW, aluminum alloy, rotational speed, tensile strength*

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I. INTRODUCTION

1.1 WELDING

Welding is a metal joining process in which fusion is obtained by application of heat and/or pressure. Combination of these two variables may be high temperature with no pressure, high pressure with no rise in temperature or both high temperature and pressure. Welding is an atomic bonding process and metallurgical bond is accomplished by the attracting forces between atoms. One beauty of welding process in comparison to other process is that by this process we can have strength of joint equal and sometime greater than the parent material. Welding is widely used to maintain or repair or fabricate all parts made out of metal around is welded, the world's tallest building, rocket engines, nuclear reactors home appliances or automobiles barely start the list. It is the most economical and efficient way to obtain a permanent joint.

1.1.1FRICTION STIR WELDING PROCESS

FRICTION STIR WELDING (FSW) is invented at The Welding Institute (TWI) of the United Kingdom in 1991 as a solid-state joining technique and was initially applied to aluminum alloys. Friction stir processing (FSP) is a solid-state process where the material within the processed zone undergoes intense plastic deformation resulting in dynamically recrystallized grain structure. In the FSW procedure, the joining takes place through the movement of a rotating shouldered tool with profiled pin plunged into the joint line between two pieces of sheet or plate material. When the rotating pin tool moves along the weld line, the material is heated up by friction produced between the shoulder of the tool and the surface of the work piece to be welded

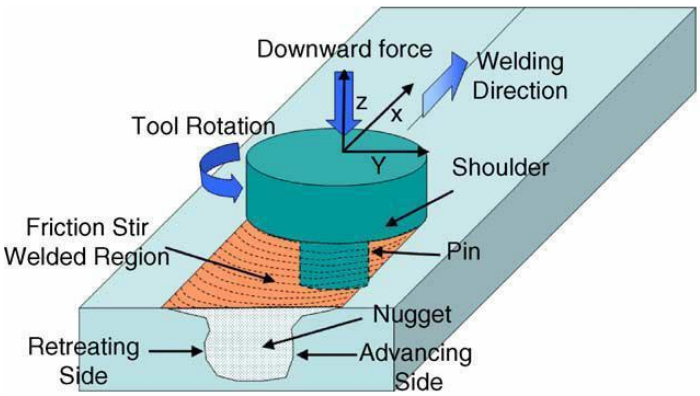


Figure .1

II. DESIGN OF TOOL

Three pin profiles like straight cylinder, fluted cylinder, pentagonal cylinders has been designed by AutoCAD and prepared from conventional lathe machining. Tool designs are shown in fig 1a, 1b&1c. Manufacturing tool was shown in fig2. High carbon high chromium die steel tool material has suitable for aluminum alloys. Compared to other materials like tool steel, high speed steel etc HCHCr strength is high, hot hardness are excess, simple process, well procured and wise also less. Dimensions of the tool are shoulder and pin diameters are 18mm and 6mm. pin length are 5.7mm.

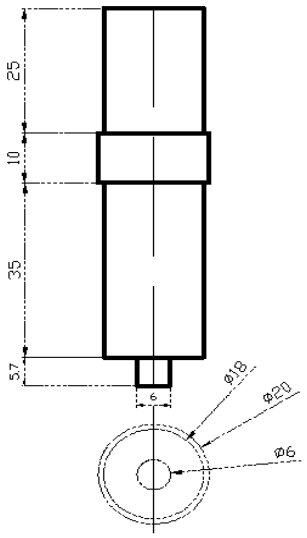


Figure .2

III. WELDING PROCEDURE

Batliboi vertical milling machine was used to produce the welding joints. Suitable Clamping devices are placed on milling machine bed and it was used to getting good welded samples and its shown in fig.3

Figure. 3

IV. RESULT AND DISCUSSION

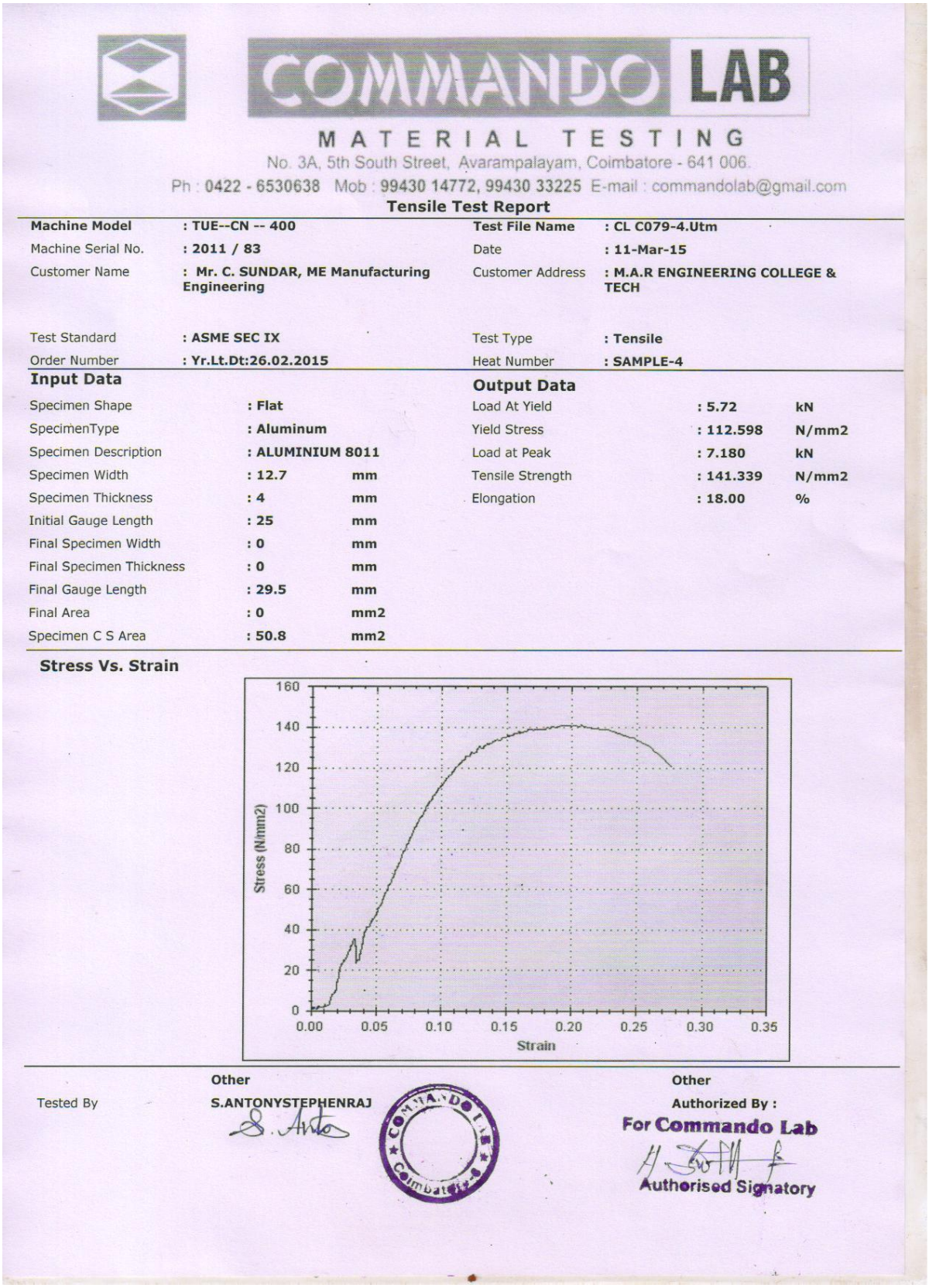
JOB.NO	RPM	FEED	AXIAL FORCE
J-1	500	20	3.7
J-2	500	20	3.7
J-3	500	20	3.8
J-4	710	28	3.8
J-5	710	28	3.8
J-6	710	20	3.8

J-7	1000	20	3.8
J-8	1000	20	3.8
J-9	1000	28	3.8

Table 1

Specimen samples Fig.4

Test samples Fig.5



COMMANDO LAB

MATERIAL TESTING

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Tensile Test Report

Machine Model	**: TUE--CN -- 400**	**Test File Name**	**: CL C079-4.Utm**
Machine Serial No.	**: 2011 / 83**	Date	**: 11-Mar-15**
Customer Name	**: Mr. C. SUNDAR, ME Manufacturing Engineering**	Customer Address	**: M.A.R ENGINEERING COLLEGE & TECH**
Test Standard	**: ASME SEC IX**	Test Type	**: Tensile**
Order Number	**: Yr.Lt.Dt:26.02.2015**	Heat Number	**: SAMPLE-4**

Input Data			**Output Data**		
Specimen Shape	**: Flat**		Load At Yield	**: 5.72**	**kN**
SpecimenType	**: Aluminum**		Yield Stress	**: 112.598**	**N/mm2**
Specimen Description	**: ALUMINIUM 8011**		Load at Peak	**: 7.180**	**kN**
Specimen Width	**: 12.7**	**mm**	Tensile Strength	**: 141.339**	**N/mm2**
Specimen Thickness	**: 4**	**mm**	Elongation	**: 18.00**	**%**
Initial Gauge Length	**: 25**	**mm**			
Final Specimen Width	**: 0**	**mm**			
Final Specimen Thickness	**: 0**	**mm**			
Final Gauge Length	**: 29.5**	**mm**			
Final Area	**: 0**	**mm2**			
Specimen C S Area	**: 50.8**	**mm2**			

Stress Vs. Strain

Tested By — Other — **S.ANTONYSTEPHENRAJ**

Other — **Authorized By :**

For Commando Lab

Authorised Signatory

Test report 1

Best sample 4 Fig.6

V. CONCLUSION

The experimental results with respect to axial force, tool rotational speed and its traverse speed are analyzed in the friction stir weld zone and joint efficiency of Tensile test was conducted, that the best sample is 4 shown in fig 6 has good ultimate tensile strength comparatively with other samples (UTS).

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