Friction stir processing of aluminum alloy and effect of number of passes

A Major Project Report

Submitted in Partial Fulfillment for the Award of the Degree of

Master of Technology

In

Mechanical Engineering

With specialization in

PRODUCTION ENGINEERING

By

SANDEEP KUMAR
(Roll No. 2K12/PRD/20)

Under the guidance of

Sh. N. YUVARAJ (Assistant Professor)

Department of Mechanical Engineering

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

DELHI TECHNOLOGICAL UNIVERSITY

DELHI-110042

SESSION 2012-14

CERTIFICATE

This is to certify that the project entitled "**Friction stir processing of Al alloy and effect of number of passes**" being submitted by me, is a bonafide record of my own work carried by me under the guidance and supervision of **Sh. N. Yuvaraj (Assistant Professor)** in partial fulfillment of requirements for the award of the Degree of Master of Technology (Production Engineering) in Mechanical Engineering, from Delhi Technological University, Delhi.

The matter embodied in this project has not been submitted for the award of any other degree.

Sandeep Kumar
University Roll No: 2K12/PRD/20

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

Sh. N. Yuvraj
(Assistant Professor)

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING
DELHI TECHNOLOGICAL UNIVERSITY
DELHI-110042
30-JULY-2014
2012-2014

ACKNOWLEDGEMENT

I have a great pleasure in expressing my deep sense of gratitude and indebtedness to my mentor, **Sh. N. Yuvraj (Assistant Professor)** of Mechanical Engineering Department of Delhi Technological University, Delhi for their invaluable and fruitful constructive suggestions and guidance that has enabled me to overcome all the problems and difficulties while carrying out multi-functionaries of the present investigation. He has guided me for fundamentals and provided many technical papers on the subject matter and thus inculcated the interest and quest for knowledge of this work. He provided constant support and encouragement for successful completion of this work. I feel fortunate for the support, involvement and well wishes of my mentor and this is virtually impossible to express them in words.

I am also grateful to Prof. Naveen Kumar Head Department of Mechanical Engineering, for providing the experimental facilities in various labs of the Department

I also have great respect and indebtedness for machine shop instructor Mr. Pardeep Kumar and CNC shop instructor Mr. Fransis and metal forming shop instructor Mr. Tekchand for their support provided for experiments, required for the completion of this special subject and I am especially thankful to Chiteka and Gorav for their help and support.

I am also thankful to all the lab assistants of my college for their kind help.

SANDEEP KUMAR

2K12/PRD/20

CONTENTS

List of Figures

List of Tables

ABSTARCT

Friction stir processing is a newly developed solid state processing technique in which a rotating tool is inserted in a work piece for localized micro-structural modification for specific property enhancement. Alloys like aluminium, magnesium, copper etc. are most suitable for friction stir processing. Friction stir processing increases the super plasticity of material. It modifies the microstructure, increases micro-hardness and tribological properties like tensile strength, wear behavior etc. are improved. The aluminium alloy (grade 1050 have major alloying elements as iron and silicon. In this study we obtain optimum traverse and rotational speeds are 25 m/min and 1600rpm after a number of trails. The square pin profiled tool produced defect free FSP region compare to other pin profiles and obtain defect free micro and macrostructure in friction stir processing region at D/d ratio 3. These are fixed based on the literature review. In this study we processed the aluminium alloy (AA1050) with square pin profile of H-13 tool material at 1600rpm rotational speed and 25mm/min traverse speed by friction stir processing. Final results shows 9 percent increase in tensile strength compare to base alloy and hardness of processed sample increase compare to base material sample and tensile elongation decrease as number of passes increase. Wear loss of processed specimen also reduced due to increase in hardness of processed sample.