Friction Welding on Lathe Machine with special Fixture

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Abstract: The purpose of this paper is describes a method of measuring the forge pressure on the conventional lathe machine. Pressure is measured by special arrangement of fixture on the tail stock side of machine. Fixture consists of hydraulic jack with pressure gauge. That pressure gauge shows the forge pressure applied by the operator on the steady job. Friction welding (FW) is a fairly recent technique that utilizes a non-consumable welding tool to generate frictional heat and plastic deformation at the welding location, there by affecting the formation of a joint while the material is in solid state. The principal advantage of frictional welding, being a solid state process, low distortion, absence of melt-related defects and high joint strength, even in those alloys that are that considered non-wieldable by conventional welding techniques. Furthermore, friction welded joints are characterized by the absence of filler-induced problems or defects, since the technique requires no filler, and by the low hydrogen contents in the joints, an important consideration in welding steel and other alloys susceptible to hydrogen damage. The technique can produce joints utilizing equipment based on traditional machine tool technologies, and it has been used to weld a variety of similar and dissimilar alloys as well as for welding metal matrix composites and for repairing the existing joints. Replacement of fastened joints with FW welded joints can lead To significant weight and cost savings, attractive propositions for many industries. FW is a leap forward in manufacturing technology, a leap that will benefit a wide range of industries, including transportation industry in general and the airframe industry in particular.

Keywords*:* **Friction welding, welding parameters- Friction time forges Pressure, mechanical characterization, metallographic**

I. INTRODUCTION

A method of operating on a work piece comprises offering a probe of material harder than the work piece material to a continuous surface of the work piece causing relative cyclic movement between the probe and the work piece while urging the probe and work piece together whereby frictional heat is generated as the probe enters the work piece so as to create a plasticized region in the work piece material around the probe, stopping the relative cyclic movement, and allowing the plasticized material to solidify around the probe. This technique, which we refer to as "friction welding" provides a very simple method of joining a probe to a work piece. The method can be used for repairing cracks and the like within a work piece or for joining members, such as studs or bushes, to a work piece. Another aspect of the invention comprises causing a probe of material harder than the work piece material to enter the joint region and opposed portions of the work pieces on either side of the joint. Friction welding is a type of forge welding, i.e. welding is done by the application of pressure. Friction generates heat, if two surfaces are rubbed together, enough heat can be generated and the temperature can be raised to the level where the parts subjected to the friction may be fused together.

In conventional friction welding, relative rotation between a pair of work pieces is caused while the work pieces are urged together. Typically thereafter once sufficient heat is built at the interface between the work pieces, relative rotation is stopped and the work pieces are urged together under forging force which may be same as or greater than the original urging force.“Friction Welding” (FW) is a group of solid-state [welding] processes using heat generated through mechanical friction between a moving work piece, with the addition of an upsetting force to plastically displace material. Many dissimilar metal combinations can be joined and there are a number of process variations including.

Types of Friction Welding

- CONTINUOUS DRIVE FRICTION WELDING
- ROTATIONAL WELDING

- ORBITAL FRICTION WELDING
- LINEAR VIBRATION WELDING

CONTINUOUS DRIVE FRICTION WELDING:

The present study utilized a continuous drive friction welding machine. In continuous drive friction welding one work piece is rotated at nominal constant speed in action alignment with the second part under an applied pressure. The rotation and pressure are maintained for the specific period to ensure adequate thermal and mechanical conditioning of the interface region. Thereafter, the rotation is stopped often with forced braking and at the same time pressure is increased to upset parts together. The application of an axial force maintains intimate contact between the parts and causes plastic deformation of the material near the weld interface.

II. ARRANGEMENT OF FIXTURE ON LATHE MACHINE FOR FRICTION WELDING

Fixture contains the Hydraulic jack with pressure gauge & that jack is hold in the tail stock with the help of foundation plate having the taper rod. That taper rod just insert in Tail stock & having Tight Fitting between them. Job is hold in hydraulic jack by using the Drill chuck in front of hydraulic jack

Fig1

Experimental set up

Continuous drive friction welding performed on the lathe machine .one job hold in chuck & other job is hold in special fixture. In this experiment we performed our experiment on High speed steel & stain less steel 316.Preparation of work pieces, other than that necessary to ensure reasonably good axial alignment& to produce the required length tolerance for a specific set of welding conditions, is not critical.

Fig.2

III. EXPERIMENT AND RESULT

Methodology of Friction welding

The process parameters considered are the speed of the work piece. Investigation is carried out for the different materials (H.S.S- M2 & S.S 316).

- All experiments are carried out on 10mm diameter work pieces.
- Three constant laps of RPM are used (1700, 2700, and 3700).
- HSS is rpm and S.S is constant & second experiment performs on same rpm but in this time position of work is replaced.
- Friction time & forge time is measured by stop watch
- Forge pressure is shown by the pressure gauge.
- Temp of Heat Affected zone can be measured by the Temp gun

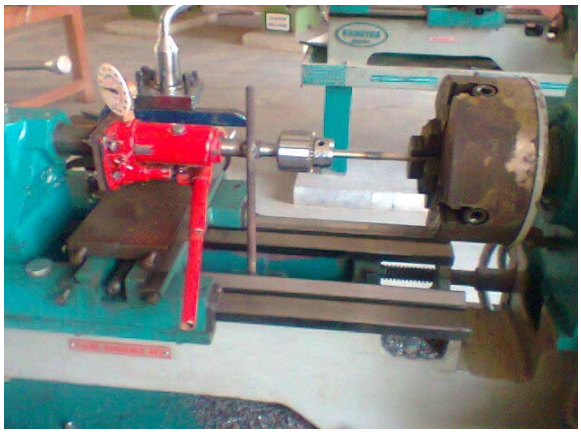

Fig.3

Experiment record

Sample	Rpm	Position	Forge pressure(kg/cm2)	Friction Time(sec)	Forge Time (sec)
S1	1700	H.S.S(rpm) S.S (steady)	100	7	35
S2	2700	H.S.S(rpm) S.S (steady)	150	7	30
S3	3700	H.S.S(rpm) S.S (steady	180	7	24
S4	1700	H.S.S(steady) S.S(rpm)	110	14	150
S5	2700	H.S.S(steady) S.S(rpm	210	14	75
S6	3700	H.S.S(steady) S.S(rpm	330	14	48

Table.1

Welded work pieces (H.S.S- M_2 & S.S 316)

Fig.4

Result:

- As increase the Forge pressure- Forge time reduces in all samples.
- S_1- S_3 H.S.S -M_2 (rpm) & S.S -316 (steady).
- S_4-S_6 S.S -316 (rpm) & H.S.S- M_2 (steady).
- Friction Time is double in S_4-S_6.
- Forge pressure in S_4-S_6 also excess comparison to S_1-S_3 Due to H.S.S- M_2 in steady condition.

IV.CONCLUSION

- It is safe on lathe machine to perform the friction welding up to bar diameter of 10mm with good mechanical properties.
- Manual force can be measured with the help of Hydraulic jack special fixture.
- Friction welding is indispensable tool for welding dissimilar metals.
- Optimum welding parameters should be properly selected in the friction welding of parts.

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