A Brief Research Review For Study of Friction Welding on Metallic and Bimetallic Welds

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Abstract
Friction welding provides a solid state welding process without adding any external filler material. It is useful for joining of metallic and bimetallic welds. These metallic and bimetallic welds impose a safety issue for the structural engineers. The metallic and bimetallic welds present a heterogeneous interface, which results in variation of micro-structural and mechanical properties across a very narrow zone. These welds also show thermal fatigue and residual stress. This paper the research review for metallic and bimetallic welds.

Keywords
Friction Welding, Metallic Weld, Bimetallic Weld

I. Introduction
The friction welding is a Solid state welding process or the method of manufacturing for joining different types of metals, i.e., ferrous metals and non-ferrous metals (dissimilar metals). In friction welding, heat is generated by friction when the two materials joined together (one is rotate and another specimen is stationery) the temperature and pressure increase so the mechanical energy convert into thermal energy. Then it is (friction welding) so easy to join ferrous metal and non-ferrous metal, there are some parameter used in friction welding as forging (upset) time, forging (upset) pressure, friction time, friction pressure, temperature measurement, burn off length and rotation speed.

II. Literature Review
It is common experience that the necessary force to commence sliding a material is greater than that to maintain motion, and therefore the coefficient of static friction is greater than that of dynamic friction. It has also been observed that the range of values of frictional forces differ by orders of magnitude depending on the length scales of the applications, macroscopic or nanoscopic. In most cases the precise value of the coefficient of friction depends strongly on the experimental conditions under which it is measured. Shinji et al. (2006) in this process the micro structural development of friction welded AZ31 alloy was studied. The microstructures near weld interface consist of mainly three regions that are recrystallized fine-grain, mixed-grain and twin regions. The most impressive micro structural feature is grain refinement. The grain refinement occurred at the friction weld interface by the dynamic recrystallization, resulting in the increasing of hardness. Duggal et al. (2008) The purpose to determine the conditions necessary to achieve satisfactory friction welds between tubular sections with varying wall-thickness at fixed outer diameters of Aluminum pipes. The effects of input parameters i.e. Rotational Speed, Forge Pressure and Weld Time on mechanical and metallurgical properties on friction welded materials were studied. As the Rotational Speed is increased, Weld Time decreases. It is also noticed that Weld Time varies linearly with Rotational Speed at low speeds and varies less slowly at high speed. It can be concluded that speeds more than the speeds at which good quality welds are obtained will result in more time to friction weld. Gill & Singh (2012) In this study the effect of heating time on the mechanical properties i.e. tensile strength, torsional strength, axial shortening, angle of twist and flash width of Nylon-6 weld joints produced by continuous drive friction welding. The heating pressure, heating time, forging pressure spindle rotation speed were the process parameters used in this study. Based on the results obtained from the increase in the heating time and keeping the other welding parameters fixed the tensile and torsional strength and of angle of twist welded specimen increases and after reaches their maximum value they again starts decrease. Kumar et al. (2012) In this process friction welded joint of dissimilar metals was made to evaluate the mechanical properties of mild steel and aluminium alloy bimetallic joint. Friction welding has been successfully employed to weld dissimilar metal. Tensile strength and micro hardness of both of the material were good and fusion joint of the material were also in good condition and the ductility was reasonable. Chemical composition of the mild steels and aluminium used for welding played an important role in deciding the properties of the weld. Handa & Chawla (2013) Continuous drive friction welding studies on austenitic stainless steel and ferritic steel combinations has been attempted in this investigation. The experimental results indicate that axial pressure has a significant effect on the mechanical properties of the joint and it is possible to increase the quality of the welded joint by selecting the optimum axial pressures. The mechanical properties of the friction welds were found to vary with the applied axial pressure, which indicates that axial pressure is an important welding parameter. The hardness found to maximum on the austenitic stainless steel side than that of low alloy steel. With the increase in the axial pressure the hardness at the center of weld cross section increases. Ruma et al. (2013) the purpose of this study was found the behavior of the friction welding joined with and without using external sources of heating. In the first stage of project specimen where prepared by friction welding at different speeds and tested for tensile and shear stress the result was that the specimen prepared at higher speed showed greater strength compare to specimen at lower speed. This study investigate the effects of spindle rotational speed and external heating on tensile breaking strength and shear strength of mild steel joint. Handa & Chawla (2013) the purpose of this method was found the low alloy steel (AISI 1021) was welded under different welding parameters and afterwards the mechanical properties such as tensile strength, impact strength and hardness were experimentally determined. The mechanical properties of the friction welds were found to vary with the applied axial pressure, which indicates that axial pressure is an important welding parameter. The axial pressure could be successfully optimized for the friction welding process on the basis of the results of the current investigation. Gourav sardana (2013) the purpose of this method was found the measuring of 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. It is safe on lathe machine to perform the friction welding with good mechanical properties. Sardana & Kumar (2013) The purpose of this work was to join and assess the development of solid state joints of dissimilar material HSS M33 and AISI 316 stainless steel, via continuous drive friction welding

process, which combines the heat generated from friction between two surfaces and plastic deformation. It observed that friction welding has been successfully employed to weld dissimilar metals. Strength of the joints obtained was good. As we increases the rpm (HSS rpm & SS constant) of job then breaking point load is decreases but when rpm (HSS constant & SS rpm) of job then breaking point load is increases at high rpm. Handa & Chawla (2013) the purpose of this method was found the study of austenitic stainless steel (AISI 304) was welded under different welding parameters and afterwards the mechanical properties such as tensile strength, impact strength and hardness were experimentally determined. The mechanical properties of the friction welds were found to vary with the applied axial pressure, which indicates that axial pressure is an important welding parameter. The axial pressure could be successfully optimized for the friction welding process on the basis of the results of the current investigation. Basheer & Noor (2013) In this research different specimen geometries (flat, pin and taper pin ceramic faces with flat metal face) of alumina and 6061-aluminum alloy were welded by direct drive friction welding to investigate the effect of joint geometry on micro structural development, micro hardness and thermal properties of friction-welded components. The welding process was carried out under different axial pressures and friction times while rotational speed (1250 rpm) and axial force (5000N) were kept constant. The experimental results showed that the shape of ceramic face had a significant effect on the joint structure, micro hardness and thermal properties. In this study, alumina-6061 aluminum alloy joints were welded successfully using friction welding. Four different ceramic face geometries were designed to investigate the effect of the shape of ceramic faces on the microstructure of the 6061 aluminum alloy. The results indicated that the shape of the ceramic face had a significant effect on the joint structure and mechanical properties of aluminum alloy. The ceramic face strongly affected the flow of metal. Good weld was acquired using the taper pin 60º shape. Hence, at the interface, a taper pin 60° shape gave the highest hardness. Boonseng et al. (2014) the purpose of this research was to study the friction welding in SSM356 aluminium alloys which was obtained from a rheocasting technique allowing the globular structure formation on base metal. The similar joints of SSM356 aluminium alloys were welded successfully by friction welding process using three different rotational speeds and burn of length. Its hardness is closed to the hardness of base metal due to heating. Faizal .B et al. (2014) the purpose of this research was to study the friction welding process is carried out for Al 6063-T6 and to find out its mechanical properties. The result of the tensile test shows that the weld zone is stronger than the base metals since the rupture occurred outside of the welding area. The quality of rotary friction welding is depending on rotating velocity of members. In this study it is clear that at high rpm material binds together due to high material penetration and hence length of the work piece is reduced after welding. Rao et al. (2015) the mechanical properties obtained at different spindle speeds are recorded and hardness at the heat affected zone is measured. The findings proved that a lathe can perform friction welding up to 20mm diameter. Investigations are carried on mild steel (AISI 1040) and aluminum alloy (AA6351), both as similar and dissimilar combinations. Thermal softening led to reduction of hardness for both similar and dissimilar metals near weld zone. S.R.Sundara Bharathi et al. (2015) The main objective of this investigation was to apply friction welding for joining of 12mm dia aluminium alloy similar joints 2024 & 2024. Later the mechanical properties of joints were examined by using tensile test, SEM fractograph analysis; macro & micro structure analysis and Vickers micro hardness test .Results are the similar joints of AA 2024 tensile strength were found. It is lesser than the base metal of aluminium alloy 2024. Similar joints of AA 2024 yielded are low when compared to base metal of aluminium alloy 2024. It is observed from the microstructure test that fully deformed zone grain size is fine than the rest of three zones namely partly deformed zone, heat affected zone and undeformed zone. Further, it is noted that undeformed zone grain size is almost equal to the parent metal grain size. From the macrostructure test, it is observed that equal deformation was observed. The micro hardness test revealed that the hardness of the similar welded joints was found. Weld interface hardness value very close to the base metal of AA 2024.

III. Conclusion

It has been observed from the literature survey that friction welded material exhibit better mechanical properties than other techniques. The effect of various parameters varies on the quality of weld. Many researchers have investigated the properties of friction welded materials with rotational speed, axial force and/or friction time as variable parameters. But the effect of end preparation on weld quality has not been reported in open literature, so it reflects the gap in the research.

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