A Literature Review on Friction Stir Welding of AluminumAlloy 6063

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ABSTRACT- This paper gives the details study of friction stir welding process. In this paper the property also defined of the Aluminum Alloy 6063 (AA6063). There are discussed the various author research on the friction stir welding and Aluminum Alloy in this literature review paper. There are also discussing the application of the Aluminum Alloy 6063. At last this paper gives the conclusion also.

KEYWORDS: Friction stir welding, Aluminum Alloy,AA6063.

INTRODUCTION- In the solid welding techniques, the surface of joining metals are made in a plasticized stage which is created due to the development of frictional heat. The various types of solid welding techniques are friction stir welding, continuous drive rotary friction welding, rotary friction welding, inertia friction welding, linear friction welding, stored energy rotary friction welding, and orbital friction welding etc.[1-4]. In this paper the friction stir welding [5-10] is discussed on details with the material AA6063.

Friction Stir Welding

Friction stir welding (FSW) is an easy and simple welding process. In the Friction stir welding the non-consumable tool is used for join two work pieces with help of high pressure and without melting the material. Heat is generated between the rotating tool and the work piece material, which leads to a softened region near the Friction Stir Welding Tool by friction. When the tool moves along with the work pieces, the mechanical pressure produced and with help of this mechanical pressure the work pieces are joined with getting forge and heat effected [11]. The applications of Friction Stir Welding are also found in modern shipbuilding, trains, and aerospace [12-17].The working principle of Friction Stir Welding is approximately similar to Friction Stir Processing.

Aluminum Alloy 6063

The composition of Aluminum alloy is controlling and maintained by the Aluminum Association. The chemical composition of AA6063 is:

Sr. no.	Material	Min. %	Max.%
1.	Silicon	0.2	0.6
2.	Iron	-	0.35
3.	Copper	-	0.10
4.	Manganese	-	0.10
5.	Magnesium	0.45	0.9
6.	Chromium	-	0.10
7.	Zinc	-	0.10
8.	Titanium	-	0.10

9. Other element no more than 0.05%each, 0.15 total.
10. Remainder Aluminum

Aa6063 is used for window frame , roof frame, sign frame, door frame and other types of frame which require low density because AA6063 possess the density is 2.69g/cm^3. It also used for Aluminum extrusion for making the complex shapes and architectural application.

The Aluminum alloy are various types which are used according to the requirements.[18-20] The AA6063 is mostly used due to their light weight , corrosive resistance and high machinability.

Literature survey on Friction stir welding (FSW) and the property of Aluminum alloyare discussed given below.

Grandfield, John, et al. conducted an experiment to determine the changes in the properties of Aluminum alloy by increasing the percentage composition of both nickel (Ni) and vanadium (V). On micro structural analysis of AA6060/6063 alloy, there was no changes in tensile properties but mild decrease in corrosive property of alloy was observed at high Ni-V levels.[21]

Bodunrin, Michael Oluwatosin, Kenneth KanayoAlaneme, et al., reviewed the effect of different combination of fortified materials which are generally used in processing of hybrid Aluminum matrix composites to examine its effect on mechanical, corrosive and wear performance. Further new advancements in the field of fabricating materials are briefly[22].

Singh, R., Saadat Ali Rizvi et al.conducted a study to check the effect of FSW on the quality of welded AA 6063 plates where three factorial design plates were optimizated by taguchi approach which led to increase tensile strength of the welded joint of aluminum alloy with high rotational speed and decrease tensile strength on increasing transverse feed as a result of frictional heat which is therefore in direct relation to rotational speed of tool.[23]

Saravanakumar, A., P. Sasikumar, et al. explored hybrid aluminum matrix composite,which is the combinations of different compositions of graphite and alumina developed by friction stir casting method. AA 6063 alloy were significantly improved on addition of alumina and graphite by analysis of compression tests, hardness and impact strength . Mechanical characterization of AA 6063 alloy showed improved mechanical properties with 6% of alumina particles [24].

Alaneme, K. K., and A. O. Aluko et al. investigated significant changes by adding borax along with two step stir casting method to improve tensile and fracture behavior of Aluminum (6063) [25].

Salih, Omar S., et al. reviewedon up-to-date Friction stir welding of AMC materials. A very critical analysis done on macrostructure and microstructure of AMC joints along with joints in conjunction to use of FSW tools of reinforcement materials in Aluminum matrices [26].

Wahid, MohdAtif, and Arshad Noor SIDDIQUEE et al provided a comprehensive detail study of UFSW, importance of UFSW in comparison to Friction Stir Welding and reported improved outcomes of UFSW technique for joint welding [27].

Das, DiptiKanta, et al. reported advancement work in heat treatment and fabrication techniques for ceramic-reinforced Aluminum matrix composites. It focuses on various optical techniques to

improvebasic material system eith help of various parameters like the compositions of contents, size, weight and volume, size of reinforcement by using fabrication heat treatment methods[28].

Estrin, Yuri, and Alexei Vinogradov explored various effects and emphasis on the role of the alloying effects of fatigue strength. They produced the direct contribution of solutes in respect with fatigue strength is stronger than indirect effect usually [29].

Balasubramanian, I., and R. Maheswaran examined the influence of varying compositions of micron-sized silicon carbide (SiC) on mechanical analysis of AA 6063. In their research they gives the result which affects the property of aluminum alloy 6063 [30].

Alaneme, K. K., and M. O. Bodunrin reported two step stir casting method to examine mechanical properties of aluminum alloy AA6063. In the two step stir casting, they find the mixing compositions in the material AA 6063[31].

Abood, Haider A examined influence of Omeprazole(OME) on the corrosive property of AA6063 in 2M NaOH solution in conjunction with gasometry measurement at temperature of 30°C and 55 °C where OME found to act as good inhibitor with inhibition efficiency in respect of increasing the OME concentration [32].

Narimani, Mohammad, BehnamLotfi et al., showed microstructural evaluations of uniformly distributed TiB_2 in aluminum matrix post Friction Stir Processing. Friction Stir Processing of AA6063 alloy was done without adding reinforcing particles therefore presented mild improvement in tensile strength is increased. The addition of other composite powder during FSP increase tensile strength to about 150 to 280 MPa therefore, results in 70% increase in strength of material [33].

Khan, Noor Zaman, Zahid A. Khan et al made an attempt to investigate the strength of shoulder diameter to pin diameter (D/d) ratio on of Friction stir welding of AA6063. Microstructures revealed refinement on the material in stir zone as a result of re-crystallization by Friction stir welding [34].

Verma, S., M. Gupta, et al.revealed Friction Stir Welding its influence on mechanical and metallurgical analysis of the weld[35].

Mehta, Kush P., and Vishvesh J. Badheka presented an article which provides a detail study on dissimilar copper and aluminum materials joined by Friction Stir Welding technology. In this article the various Friction Stir Welding parameters are taken for finding the welding defects and microstructure of the aluminum alloy 6063. Theses parameters which are finding the welding defects and micro structure is tool design, rotational speed, welding speed, tool tilt angle, and position of work piece material.[36]

Samaee, M. et al. discussed on the new idea on the grain refinement with severe plastic deformation with a thermal treatment for creating a good initial grain structure with a high degree of super saturation was taken for increases in the mechanical properties like that hardness, strength and ductility of the Aluminum Alloy AA6063. [37]

AlanemeaΨ, Kenneth K., and Ayotunde O. Alukob produced the Al 6063/SiCp composites having low porosity levels with the monolithic alloys. They check the property of this new composite material and find fit according to the requirement. [38]

Rajasekaran, B., et al influenced the detonation gun sprayed alumina coating on AA 6063. The test samples with the gun sprayed alumina coating subjected to cyclic loading with and without fretting are found that these samples are provided better cleaning performance than simple aluminum alloy 6063. [39]

Moreira, P. et al. offered the possibilities by friction stir welding (FSW), data concerning and its mechanical behavior. In this work the influence of FSW on the fatigue life of specimens of Aluminum alloy 6063-T6, containing affected zone was studied. [40]

Subramaniam, Senthilkumar used friction stir welding tools with different pin profiles of square, circular, and triangular for joining the aluminum alloy AA6063-T6 flat plates. Here they applied for monitoring the new technique of Acoustic emission. They also analyzed the tool pin profile effect on tensile strength of the welding joints. They also studied A correlation between the acoustic emission signal parameters and the tensile strength of the welding joints. [41]

Luo, Alan A. et al. investigated the properties of hydro formed sections of the aluminum alloys 6063. They investigated the properties of microstructure and fatigue. In this research they found that the low fatigue strength of 6063-T7 is related to its relatively large grain size. [42]

Mohammed Razzaq, Alaa, et al focused on the compo casting technique. They used this techniques for the fabrication of the AA6063 with fly ash particles. They found in their results that when the fly ash content is increase in the melted leads, the micro hardness and porosity also increased in the composites. 43]

Dumoulin, S., et al. investigated the influence of grain interactions with finite elements. They used to model the behavior of the polycrystal in their research work. It is found in their result that the grain discretization has minor influence in the predicted plastic anisotropy.[44]

Sun, Yavuz examined the micro structure AA 6063 aluminum alloys containing up to 2% Ti. They also analyzed room temperature dry sliding wear performance in their research under homogenized and heat-treated conditions. A scanning electron microscope (SEM) was used for analyzing the microstructure of the homogenized and aged alloys. Hardness measurements test and wear test were carried out using a micro hardness test. [45]

After the finding property of aluminum alloys and then select the suitable material according to the requirement purposes the fiction stir welding is done on the material. The fiction stir welding process is to be done after to see the effects of their thermal, mechanical, thermo-mechanical and other required property [46-50].

CONCLUSION

This literature review paper, the details study of friction stir welding process and Aluminium Alloy are discussed. In this paper the property also discussed of the Aluminium Alloy 6063 (AA6063). There are discussed the various author research on the friction stir welding and Aluminium Alloy. There are also discussing the application of the Aluminium Alloy 6063.

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