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Investigation of Tool Pin Profile Studies of Friction Stir Welded Joints of Aa5052-H32 & Aa6061-T6 Aluminium Alloys

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ABSTRACT: In friction stir welding process, the tool pin profile plays an important role which has to be found for mixing the materials to be joined. of suitable pin profile will reduce the defects to be formed in the welded joints and improve its welded joint efficiency. The friction welded joints of AA5052-H32 and AA6061-T6 were subjected to mechanical and Metallurgical Characterization for its efficiency improvement of welded joints by suitable pin profile has to be researched.

I. INTRODUCTION

The joining of dissimilar materials is becoming increasingly important in industrial applications. Many engineering applications such as power generation, chemical, petrochemical, nuclear, aerospace, transportation and offshore construction require the joining of dissimilar materials using different method, especially friction welding and friction stir welding. Due to the different chemical, mechanical and thermal properties of materials, the joining of dissimilar materials, presents more challenges than joining similar materials.

II. RELATED WORK

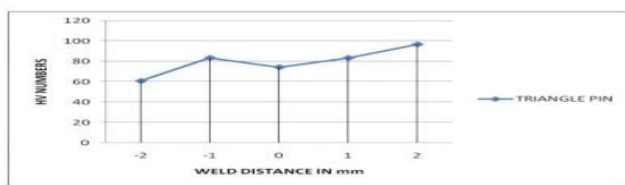
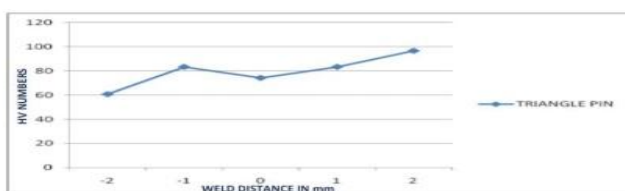
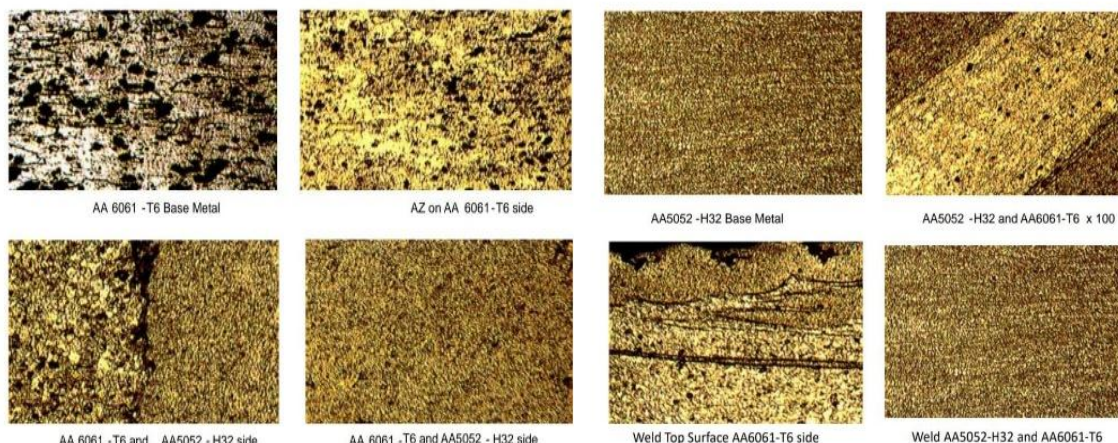
The concept of welding was first introduced by M. Ilangoan at [1] demonstrates the fusion welding of dissimilar heat treatable and non-heat treatable aluminium alloy faced many problems related to solidification. At [2] Heena k sharma explains the Aluminium alloy 6061 and Magnesium alloy AZ31 plates of 6mm thickness are welded in circular butt joint geometry by friction stir welding (FSW) process, using CNC vertical milling machine. At [3] Biswas p, Kumar DA, Mandal NR demonstrates the present investigation had two objectives: first, to study the effect of the geometry of the tool pin, and second, the effect of tool rotation and welding speeds on the mechanical properties of friction stir welded joints made for samples of commercial grade aluminium alloys. At [4] Shanavas. J. Edwin raja daas, J. Paulo David demonstrates geometry of tool pin profiles plays a significant role in deciding the quality of weld in friction stir welding process. At [5] Pa Sadeesh, M Venkatesh Kannan, V Rajkumar, Pa Avinash, Na Arivazhagan, K Devendranath Ramkumar, S Narayanan Procedia demonstrates Engineering 75, 145-149, 2014 The joining of dissimilar AA2024 and AA6061 aluminium plates of 5 mm thickness was carried out by friction stir welding (FSW) technique.

III. METHODOLOGY

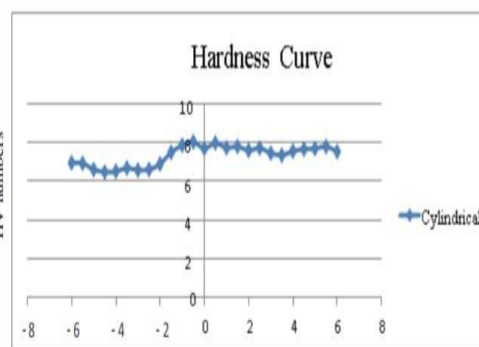
First the aluminium alloys AA5052 H32 and AA 6061 T6 are Welded by using friction stir welding. The optimization of tool pin profile plays a major role in welding. The suitable welding parameters are optimised and analysed. After welding the region is analysed under microstructure analysis and evaluation of mechanical properties of weld joints. Then the results are analysed

IV. EXPERIMENTAL RESULT

MICROSTRUCTURE STUDIES OF CYLINDRICAL WELDED JOINTS



Hardness curve for triangular joint



Hardness Distribution curve for cylindrical

Tensile properties of FSW joints

Material	Tensile Strength, MPa	Elongation, %	Joint Efficiency, %
Base Metal – AA5052-H32	222	12	-
Base Metal – AA6061-T6	325.08	15.93	-
DFSW joint Properties for CYLINDRICAL PIN	162.18	7.857	73.05
DFSW joint Properties for TRIANGLE PIN	174.27	13.83	78.5

The joint efficiency is calculated and tabulated. The joint efficiency of the DFSW joints 78.5% for the triangular pin profile is higher than the DFSW joints 73.05 of the cylindrical pin profile. Triangular pin profile shows greater joint efficiency than the cylindrical pin profile.



V. CONCLUSION

The tensile strength of the DFSW joints of the triangular pin is 174.27MPa which is higher than the cylindrical pin profile is 162.18MP. An improved hardness of HV 83.4 in TMAZ and HV 74.3 in weld nugget which is higher than the weak base metal 5052 H32 and nearer value of 6061 T6 base metal. Higher grain boundary fraction and formation of brittle inter metallic phases at the weld improve the hardness.

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