A Literature Review on Tig Based Wire Arc Additive Manufacturing

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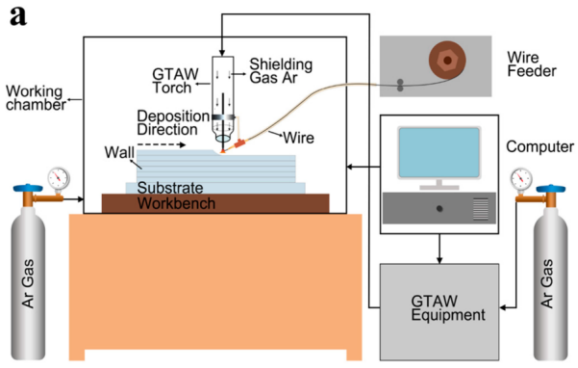
***Abstract* - To compromise the growing demand for raw material in aircraft and automobile industries and to replace the common conventional machining and avoid the wastage from the conventional machining process. Metal 3D printing is also known as additive manufacturing, Wire arc additive manufacturing is technique comes under the additive manufacturing. This paper focus on the review of TIG based wire arc additive manufacturing and gives information of various techniques and methods used for WAAM.**

I.INTRODUCTION

GTAW is a welding process widely used for joining and repair works in many sector like automobile, aircraft industries and marine time application, it uses non consumable tungsten rod as an electrode and the wire feed can be done by manual or automatically helium and argon can be used as shielding gas to avoid condemnation in the weld pool during the welding operations shielding gas can be varied based on the metal to be weld. GTAW are widely used for depositing aluminum, magnesium, titanium steel, copper and nickel based super alloys.



GTAW setup for WAAM Wu et al., [1]

Above figure represented the layout for GTAW based WAAM it consist of 3D modeling CAD and welding torch, wire feeder, shielding gas cylinder, and power source for total operation. Design is programmed in the computer using CAD and the total operation is done automatically, the torch moves according to the program feed in CAD and multilayer is deposited layer by layer after each layer a dwell timing is given for depositing another layer, wire feeding speed, torch travel speed, current and shielding gas can be optimized for a better deposition.

II.LITERATURE REVIEW

1. Tabernero et al., compared the high deposition rate welding process like PAW, CMT and Top TIG and study their mechanical properties anisotropy and classified and concluded selection of which method according to the nature of filler wire, that can improve the quality of materials fabricated in WAAM.[2]
2. Williams et al., Concluded the optimum parameter for depositing aluminum wire in TIG at electrode positive and studied optimum percentage for formation of multilayer in TIG for WAAM and investigated the microstructure at different EP% and concluded the time cycle for TIG.[3]
3. Bai et al., investigated the deposition 2219 al wire in TIG and studied the microstructure and mechanical properties like fracture properties in tensile as well as hardness test and concluded the mechanical properties of the 2219 aluminum wire in TIG for wire arc additive manufacturing.[4]
4. Geng et al., by using mathematical model to calculate the fly angle of TIG tip on the weld pool and also optimized the angle of torch and distance of the TIG tip from the substrate for producing a smooth layer for the WAAM.[5]
5. Zhang et al., investigated the Er2594 microstructure, crystal characterization and

mechanical testing for the TIG based WAAM and concluded the their effect on their characterization and noted the conclusion for the various purposes on their anisotropy analysis.[6]

6. Z.pan et al., reviewed the process planning for the WAAM and pattern and different ideology should be studied for working in the WAAM layer deposits and essential mechanical properties should be understand and welder quality should be included on the selection of which process and nature of filler wires.[7]
7. Singh et al., reviewed the CAD modeling and various development in WAAM and their challenges and optimizing their parameter for the formation of multilayer and wire feed rate, torch travel speed, and the shielding gas supply and the setup of the WAAM power source and the CAD modeling aspect should be mainly focused in their important criteria are discussed.[8]
8. Yang et al., investigated the by deposited bulky sample of TiB2/Al-Si composites in TIG based WAAM and studied the microstructure, mechanical properties of the sample by after heat treatment T6 and observed the variation occurred like defect such as pore in the surface and other defect that are present in the sample.[9]
9. Zuo et al., Investigated the hybrid arc by the combination of MIG and TIG, arc is produced by TIG torch and the wire feed is feeded by the MIG torch this torch combination produces the hybrid heat source for WAAM al 5356 was deposited and its microstructure, mechanical properties, SEM and hardness valves are analysis.[10]
10. Cheepu et al., studied about the super TIG for WAAM and conclude the more effective than normal conventional TIG and also investigated about the waiving effects and its heat circulation and microstructure formations[11]
11. Zhang et al., used the TOP-TIG method to fabricate super duplex stainless steel, and fined the perfect combination of corrosion resistance and mechanical properties was obtained in WAAM.[12]
12. Cai et al., Studied deposition of two titanium wires in both TOP TIG and normal conventional TIG and experimented their parameters in weld molten and also tested the microstructure and mechanical properties in TOP TIG and normal TIG.[13]
13. Zhang et al., analyzed the microstructure, mechanical properties, and crystallization of low alloys steel by deposit in Top TIG for WAAM.[14]

III.CONCLUSION

WAAM is technique which going to replace the normal conventional machining process, main welding process are going adopted for WAAM process GTAW, GMAW and PAW are going to dominate in the future WAAM based production process. WAAM is a related to welding process so it can suffer residual stress and porosity and some common welding defect can be found in WAAM. More research is going to develop the WAAM.

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