

EFFECT ON MICROSTRUCTURE AND MECHANICAL PROPERTY OF 4043 WIRE ARC ADDITIVE MANUFACTURED ALUMINUM ALLOY WITH DIFFERENT PROCESS PARAMETERS

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ABSTRACT

In this research work wire arc additive manufactured (WAAM) components have been prepared with 1.2 mm diameter 4043 filler wire on 8mm thick pure aluminum substrate by employing Gas Tungsten arc welding (GTAW) as an arc source. This paper explores the influence of macrostructure, microstructure and mechanical properties of WAAM deposit samples by applying different process parameters. Double and triple layered deposits are built by keeping deposition mode, deposit speed, gas flow rate and deposit current constant. The effect of time interval between the deposits, use of copper core and re-melting of the deposit on solidified structure are investigated. Double and triple layers deposit components have prepared by providing 2 minute and 5-minute inter-layer time interval. In double and layered samples recorded finer α -Al dendritic structure samples containing 5-minute time interval compared to 2-minute inter-layer time gap samples. The hardness of 2nd deposit of double layered samples was $74 \pm 5 \text{HV}0.05$ and for 1st layer it was $60 \pm 5 \text{HV}0.05$. The hardness values were recorded $74 \pm 5 \text{HV}0.05$ of layer 1, $65 \pm 5 \text{HV}0.05$ layer 2 and $60 \pm 5 \text{HV}0.05$ of layer 3 for triple layers samples. The double and triple deposits were re-melted partially and, in both cases, fine α -Al dendritic structure has achieved compared to non-re-melted samples which has been proved by the obtained hardness values from those samples such as $76 \pm 5 \text{HV}0.05$ to $65 \pm 5 \text{HV}0.05$ for double layered samples and for triple layer samples 3rd and 2nd deposit is $77 \pm 5 \text{HV}0.05$ & 1st deposit is $62 \pm 5 \text{HV}$. The three layered four walled deposits made with copper core recorded fine α -Al grained solidified structure compared to the deposits fabricated without the copper core. Microhardness of samples prepared with copper core with molding sand was $74 \pm 5 \text{HV}0.05$ whereas the hardness of as-deposit components of 3rd and 2nd layer is $68 \pm 5 \text{HV}0.05$ & 1st layer is $60 \pm 5 \text{HV}0.05$.

Keywords: Wire arc additive manufacturing, Gas Tungsten arc welding, Copper core, Re-melting, Macrostructure, Microstructure, Microhardness.

