

Invited Review Article: Strategies and Processes for High Quality Wire Arc Additive Manufacturing

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Wire Arc Additive Manufacturing (WAAM) combines the use of wire and electric arc as a fusion source to build components in a layer-by-layer approach, both of which can offer significant cost savings compared to powder and alternative fusion sources, such as laser and electron beam, respectively. Meanwhile, a high deposition rate, key for producing such components, is provided, whilst also allowing significant material savings compared to conventional manufacturing processes. However, high quality production in a wide range of materials is limited by the elevated levels of heat input which causes a number of materials processing challenges in WAAM.

The materials processing challenges identified include the development of high residual stresses, undesirable microstructures, and solute segregation and phase transformations at solidification. The thermal profile during the build poses another challenge leading to heterogeneous and anisotropic material properties.

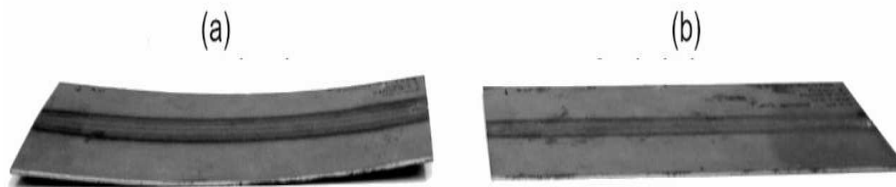


Figure 17 Distortion found in 1.5mm thick SS316L sheets
a) conventional butt welding and b) Dynamically Cooled

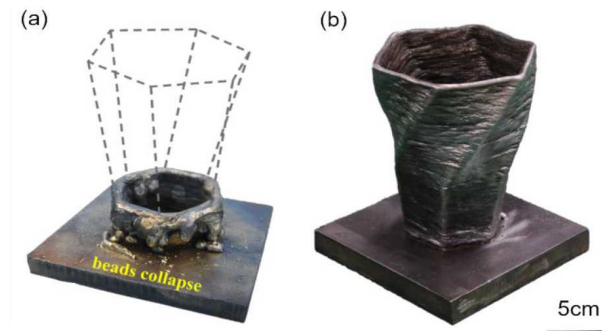


Figure 19 WAAM deposition (a) without
(b) with water cooling of base of substrate