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Controlling Bead Shape in Wire Arc Additive Manufacturing via Direct Roll Forming of Molten Metal Pool

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Wire Arc Additive Manufacturing (WAAM) is a multi-bead deposition metal 3D printing process that melts and stacks metal wires using an arc heat source. The shape of the bead varies depending on deposition conditions and affects the tool path and the appearance of the final output. Controlling the shape of the bead in WAAM can enhance the structural stability and reliability of the output and enable various applications. Plastic deformation of the bead can be induced by applying a high-load external force, such as in rolling or peening processes. However, these methods necessitate additional processes and expensive equipment. In this study, a roller pressurizing device applicable to WAAM was developed, inducing bead shape deformation. CMT welding was performed using a 6-axis robot and Mig welder, and the roller pressurization of the molten pool was observed using a high-speed camera. The pressurizing device is attached to the torch, so no additional power source is needed, and the bead shape can be easily modified without a high-load device.

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