ELECTRON MULTIBEAM ADDITIVE PROCESS FOR HIGH PRODUCTION MANUFACTURING LARGE METALLIC COMPONENTS

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Fast development of additive manufacturing is a global challenge in modern technology development, which determines provisions for developing and using new advanced, high-production and competing processes. This work has been focused on developing an electron multibeam additive directed energy wire deposition process and commercial high-production robotic equipment for manufacturing large metallic components.

This process involves a layer-by-layer deposition of metal by electron beam melting of wire and obtaining then an near-net-shape component. The advantage of this process is its high deposition rate up to 12 kg/h which is unachievable with other additive processes. Also it allows making large up to 5000 mm size fully dense and structurally homogeneous components from both refractory and heat-resistant alloys. Extra feature of this process is a feasibility of simultaneous deposition of dissimilar metals and thus forming a composite structure inside a vacuum chamber. Therefore, it excludes any oxidizing of the component [1-3].

Samples will be manufactured from hot-strength alloy ZhS6U, stainless steel 12Kh18N10T and titanium alloy VT-6. The process should meet the requirements as shown in Table.

Table 1. Equipment characteristics

Building rate	5 - 12 kg/h
Wire feed	automatic
Number of wire feed devices	1 to 3
Number of electron guns	1 to 3
Residue pressure in a chamber	$\leq 1 \times 10^{-4}$ mm mercury column
Positioning accuracy	≤0,1 mm
Max current	100 mA
Max voltage	30 kV
Focal distance	200 mm

The project implementation allows filling a commercial niche both in home and abroad markets of equipment and materials needed for high-production additive manufacturing of large complex shape components. Achieving such a goal will provide our technological leadership in high-production electron beam additive manufacturing.

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References

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