

High hardness high entropy alloy by wire arc additive manufacturing

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ABSTRACT

High-entropy alloys (HEAs) are a relatively new class of materials that are based on multi component principle alloying elements approach forming supersaturated solid solution. Such alloys are composed of alloying elements in equal proportions. These materials have been found to have exceptional mechanical properties, such as high strength, ductility, corrosion and wear resistance, making them perspective for a variety of applications.

Combining WAAM with HEAs can offer a number of advantages. The most valuable is a cost-effective and efficient process for producing large-scale components. In the case of soft HEAs (such as Cantor), it is possible to manufacture solid wire or use multi-component wires cord. However, treating high-hardness alloy it becomes impossible to fabricate solid wire with appropriate composition. The solution to such a complex technological task is proposed in the current work.

The proposed method is based on gas metal arc welding (GMAW) with metal powder-cored wires (MPCW). The filling of the wire contains powder components in equal amounts relative to each other. Such an approach is beneficial compares with alternative methods of obtaining bulk alloy as melting in vacuum or argon-plasma melting, firstly due to the predominance in the molten volume of the workpiece. Further development of this approach is discussed on the example of a high hardness eutectic high entropy FeCoNiAl alloying system doped with Ta. The WAAMed alloy is characterized by almost zero plasticity, which is become prominent after the application of the special heat treatment procedure.

BIOGRAPHY

Dr. Zavdoveev has expertise in material science and passion in high entropy alloys.

