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PROCEEDINGS

Recycling of Spent CuCrZr Powder by Laser Powder Bed Fusion: Microstructure Evolution and Properties

Lizheng Zhang[1,2], Jimin Chen[1,2,*] and Yong Zeng[1,2,*]

[1]School of Physics and Optoelectronic Engineering, Beijing University of Technology, Beijing, 100124, China
[2]Beijing Engineering Research Center of 3D Printing for Digital Medical Health, Beijing, 100124, China
[*]Corresponding Author: Jimin Chen; Yong Zeng. Email: jimin@bjut.edu.cn; zengyong@bjut.edu.cn

ABSTRACT

In laser powder bed fusion (LPBF), the unmelted powder recovered from the powder bed is degraded due to particle-laser interaction during continuous processing. The sensitivity of LPBF performance and molding quality to powder properties, waste powder is usually discarded after several molding cycles, which increases the cost of raw materials. At the same time, the low laser absorption rate and high thermal conductivity of copper and copper alloys inhibit the complete melting of copper powder prepared by LPBF. Therefore, it is challenging to fabricate copper alloy components with full high density and high conductivity through LPBF. In this paper, a method of treating waste LPBF copper powder by adding graphene and preparing fully dense copper alloy parts with high electrical and thermal conductivity is proposed. This method significantly reduces the high laser reflectivity of copper powder and makes the waste powder recycled. Firstly, the effect of process parameters on the preparation of copper matrix composites by LPBF was studied, and the metallurgical defects were regulated to reveal the densification mechanism of LPBF forming process.The optimal process window was obtained, and the products with relatively crack-free, compactness and excellent performance were realized. The properties of the prepared copper matrix composites reached the properties of the new copper powder. Then, the effects of graphene on the phase, microstructure and properties of copper matrix composites were studied, and the mechanism of graphene reinforced copper matrix composites was analyzed.

KEYWORDS

Additive manufacturing; laser powder bed fusion; copper matrix composite; CuCrZr; microstructure

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