

Cast low-density high entropy alloys. Synthesis from oxide raw materials by centrifugal SHS process

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High entropy alloys (HEAs) or compositionally complex alloys are a new effort in materials science and engineering [1]. Depending on the alloy compositions, HEAs can possess many interesting mechanical and physical properties, and particularly they have great potentials to be used as high temperature materials, or coating materials requiring high hardness and high wear resistance [2].

Nevertheless preparation of the multicomponent materials is not easy science and technological task. We should promote high homogeneity (fine distribution of all elements into volume of alloy). Besides if the alloy content high chemical active component (Ti, Al, Zr, Hf *etc.*) it require use expensive mold materials and complicated techniques.

In a previous study, we examined the possibility of obtaining cast HEAs based on the 3d and 4d elements [3]. In this work we investigated a cost-effective SHS process for fabricating cast low-density HEAs through the following aluminothermic reaction:



where (MeO) – oxide raw materials, etc.; Al-metal reducer, FA is an additive facilitating phase segregation, and Q the reaction heat.

Since vigorous metallothermic reactions are accompanied by splashing and loss of material, the process can be made much more effective when carried out in conditions of high artificial gravity [4] as in centrifugal machines. This affords to improve the yield of target product, facilitate the removal of gaseous products, diminish the grain size in the product, and make product more uniform (submicron and nano-size structural components).

The cast low-density HEAs will be discussed. SHS-produced cast alloys take advantage of their low production cost, fine-grained and uniform structure. Such alloys can find their application in aerospace industry.

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