BIMETALLIC 17-4 PH/CoCrMo STRUCTURE FORMATION BY DIRECT METAL LASER SINTERING

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Bimetallic structures are an excellent solution for a lot of engineering applications which require varying properties at different locations of the same object. Implementation of such structures into engineering fields can lead to easier maintenance, economical and space savings and can also open wider application possibilities. It is known that combining multiple materials together can result in customized chemical and mechanical properties of manufactured parts, such as electrical and thermal conductivity, hardness, corrosion resistance, etc. [1]. In recent years, production of bimetallic structures has been made possible with help of additive manufacturing (AM) technologies. Using laser powder-bed fusion (L-PBF) AM, there are a few different ways how bimetallic structures can be created: printing one material on a conventionally manufactured substrate from another material [2], printing one material after another [3] or using two powders in one layer by mixing them together [4].

In this work, two materials in powder form were used for bimetallic structure formation – CoCrMo and 17-4 PH stainless-steel. The bimetallic structure was successfully produced by using the L-PBF technology applied in EOSINT M280 machine. In-depth analysis of the 17-4 PH and CoCrMo materials and microstructural properties of the produced bimetallic sample were investigated in this study.

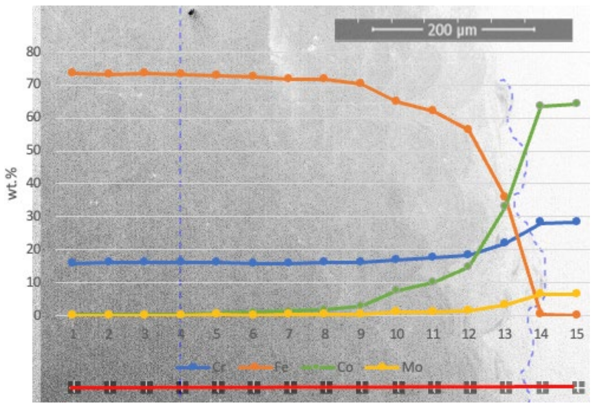

Fig. 1. Chemical element (Cr, Fe, Co, Mo) distribution in the 17-4 PH/CoCrMo fusion zone (red line marks the measurement location).

A gradual change in chemical element distribution is observed at the two-material fusion zone. The thickness of the fusion zone is around 400-450 µm.

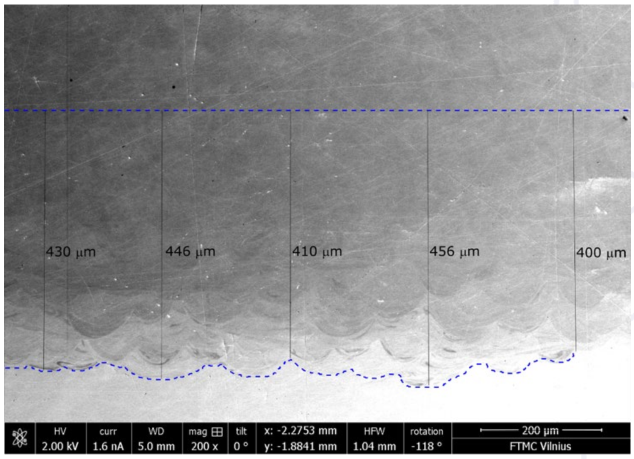

Fig. 2. Thickness of the fusion zone.

The hardness of the fusion zone (104±2 HRB) is higher than the hardness of 17-4 PH (95±2 HRB) but lower than CoCrMo (111±2 HRB). The experimentally evaluated density of the bimetallic specimen is 8.01 g/cm^3. The difference in values proves that the fusion zone of the specimen possesses unique characteristics that are not specific to either of the materials.

Table 1. Hardness of 17-4 PH, CoCrMo and the fusion zone.

Material/position	Hardness (HRB)	Density (g/cm^3)
17-4 PH	95±2	7.75
CoCrMo	111±1	8.30
Fusion zone	104±2	8.01

References

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