

Influence of heat treatment on properties of SD251-PH1 composite produced by additive SLM technology

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Abstract:

This study evaluates how heat treatment affects the structure and properties of the engineered composite material SD251-PH1. This material was formed by mixing two powder blends in a weight ratio of 90 wt. % WC-Co powder SD251 with 10 wt. % of a PH1 steel precipitation hardenable powder. Samples were prepared from this mixture on an additive device of the SLM type using parameters in which their structure was formed by different types of porosity. The printed samples were then divided into groups. Some of them were left and the rest were used for heat treatment based on the norm ASM 5659. Light and electron microscopy metallographic analysis together with X-ray diffraction analysis were then used to evaluate structural and phase changes in the volume of the prototype samples. These analyses were performed before and after heat treatment. The main attention was paid to changes in the phase composition of the samples. In addition, changes in the size and shape of the pores and tungsten carbide (WC) grains were studied. The metallographic analysis was supplemented by an evaluation of the changes in their mechanical properties and wear resistance. Vickers hardness measurements and the ball on disc test were used for this purpose. The experiments showed that the selected heat treatment processes precipitated new structural phases which differed from the original sample structure in terms of shape, size, chemical composition, and mechanical properties.

Key words:

SLM technology, heat treatment, WC-Co, porosity, phase transformation