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New dual-hardening AM alloy for tooling in HPDC

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Hot work tool steels are generally used among others for applications in aluminum pressure die-casting. Laser based additive manufacturing (AM) technologies allow producing dies and inserts with complex geometries and conformal cooling, resulting in higher product quality and increased process profitability. Nowadays only few steel powder alloys for AM of dies and tools are adopted widescale. Due to their easy printability, mainly 18%Ni-maraging steels such as W722 (DIN 1.2709, ≈ Maragin 300) are used. Nevertheless, they are originally not designed for applications in pressure die-casting, according to their mechanical and thermophysical properties. The major disadvantages compared to typical hot work tool steels type of H11 (DIN. 1.2343) or H13 (DIN. 1.2344) is their lower resistance against thermal shock and chemical dissolution of the steel by the liquid aluminum. However, H11/H13 are critical to process by the Selective Laser Melting (SLM) process and should be preheated to at least 200℃ because of their high carbon content of approximately 0,4% wt. Therefore, the research and development of new steel alloys with high process stability and hence reproducible quality by SLM is necessary

In this work, a new dual hardening model alloy W808 AMPO particularly developed for SLM processing of dies and tools in aluminum pressure die-casting will be presented. Samples are printed on SLM 280 HT at different preheating temperatures. Subsequently the mechanical and thermophysical properties in the fully heat-treated conditions are analyzed. The corresponding microstructures are investigated using optical microscopy and scanning electron microscopy. Furthermore, the test alloys are examined regarding their thermochemical and thermal shock resistance. The results are compared and discussed with those of W722 (1.2709) as well as W300 (H11, 1.2343).

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