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Effect of titanium carbide additivation on the microstructure and processability of H13 tool steel in PBF-LB/M

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In-situ alloying via laser-based powder bed fusion of metals (PBF-LB/M) has gained attention as an alternative to pre-alloyed powders. In steel making, this method is particularly advantageous for the additivation of carbides like titanium carbide (TiC) which should not fully melt during the PBF-LB/M process. On the one hand side, this ensures that the carbon content in the steel matrix is not excessively elevated, thus reducing the risk of cracking, compared to pre-alloyed steels with high carbon content. On the other hand, this method offers the potential to realize a mixture of coarse carbides being advantageous for resistance against abrasive wear and fine carbides which form by re-precipitation and contribute to grain refinement, secondary hardening and an isotropic microstructure. This study focuses on determining the limits of TiC, added to H13 tool steel powder, that can still be processed effectively using PBF-LB/M, while evaluating the influence of TiC content on the resulting microstructure. To achieve this, H13 tool steel powder was mixed with varying amounts of TiC. During PBF-LB/M, the laser scanning speed was varied to examine the influence of energy input on the dissolution of the carbides and on the material properties. The microstructural characteristics were analyzed and hardness tests were performed. The results are compared and discussed to assess the relationship between TiC-particles added to the steel powder, laser processing parameters and the resulting microstructure.

Speaker Country

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Are you interested in publishing the paper in a Steel Research International special issue?

Yes

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