

Accepted Manuscript

Crystal Structure Analysis of M2 High Speed Steel Parts Produced by Selective Laser Melting

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PII: S1044-5803(13)00211-8
DOI: doi: [10.1016/j.matchar.2013.07.010](https://doi.org/10.1016/j.matchar.2013.07.010)
Reference: MTL 7382

To appear in: *Materials Characterization*

Received date: 22 February 2013
Revised date: 10 July 2013
Accepted date: 12 July 2013



Please cite this article as: Liu ZH, Zhang DQ, Leong KF, Chua CK, Crystal Structure Analysis of M2 High Speed Steel Parts Produced by Selective Laser Melting, *Materials Characterization* (2013), doi: [10.1016/j.matchar.2013.07.010](https://doi.org/10.1016/j.matchar.2013.07.010)

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Abstract: M2 high speed steel (HSS) samples were produced by an additive manufacturing (AM) process, selective laser melting (SLM). The observed microstructure from SEM and FIB was characterised by a continuous and homogeneous network of dendrites within two different phases. These phases were characterised to be bcc single crystals and fcc/bcc polycrystals from TEM-SADP. EBSD results also indicated that the bcc grains were randomly orientated. In addition, the lattice constants from two different SADPs of bcc crystal were calculated to be 2.892 Å and 2.905 Å, larger than high purity iron bcc structure of lattice constant 2.867 Å. The elements V, Cr, Mo, W and Si were detected in the iron matrix with TEM-EDS. These elements were responsible for the enlargement of the lattice constant. TEM-EDS results also indicated that the network of dendrites were carbides. These results gave insights on the rapid solidification phenomenon in SLM.

Keywords: Selective Laser Melting, Transmission Electron Microscopy, High Speed Steel, Microstructure Characterisation, Crystal Structure Study.

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