

# Additively manufactured conformal cooling tool holder for wire drawing utilizing triply periodic minimal surfaces

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Wire is all around us and it forms joints in our structures, stabilizes our tires and transports electricity. In almost every complex product there are components made from wire. In wire drawing hot rolled material is drawn through a single or a series of tools called drawing dies, reducing the cross-section and enhancing the mechanical properties of the material. The tribological conditions in wire drawing are quite extreme and the high friction between the wire and the die which leads to plenty of heat going into the die, resulting in high tool temperatures. Previous studies have shown that by reducing the tool temperature it is possible to increase the productivity without risking an increased tool wear, this makes the cooling of the tool of high importance for the wire drawing process. Triply periodic minimal surfaces (TPMS) which have lately been enabled to be manufactured by the use of additive manufacturing (AM) have shown great potential to be used for cooling applications with demand on high efficiency. In this study a tool holder for wire drawing was designed utilizing TPMS and was manufactured using laser powder bed fusion (LPBF). The cooling efficiency of the manufactured tool holder was evaluated and compared to a conventional tool holder in an industrial wire drawing process. The study shows promising results on improving the cooling efficiency in the process by using the TPMS AM tool holder.

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