Masterproef industriële ingenieurswetenschappen

Selective Laser Melting for production of injection moulds

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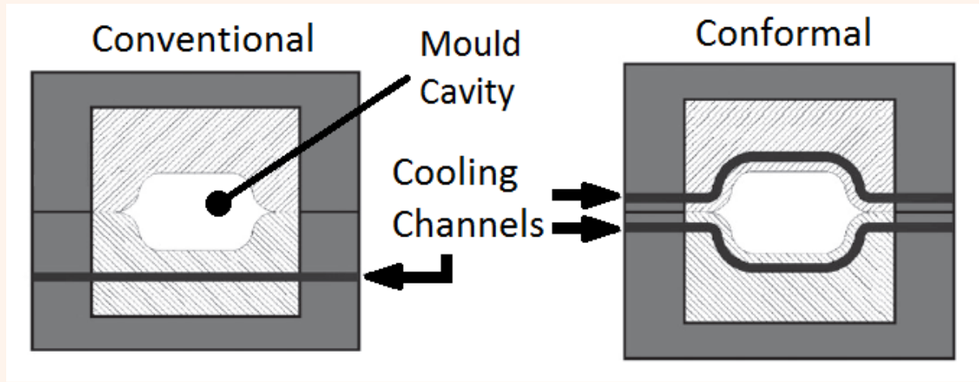
Problem

Cooling in Injection moulding

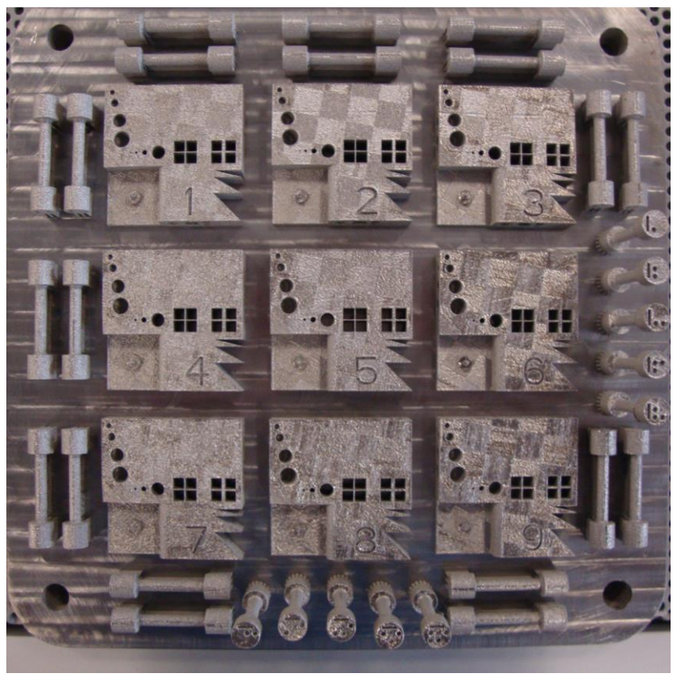
Injection moulding is the process of injecting molten material into a mould cavity and ejecting a solid product. To improve the process the moulds are cooled after each injection. Conventional cooling channels are drilled into the mould block leading to an inefficient cooling in most cases. This masterthesis aims to investigate which opportunities the design freedom of the Selective laser melting 3D-printing technique can provide to improve cooling by producing mould with conformal cooling channels.



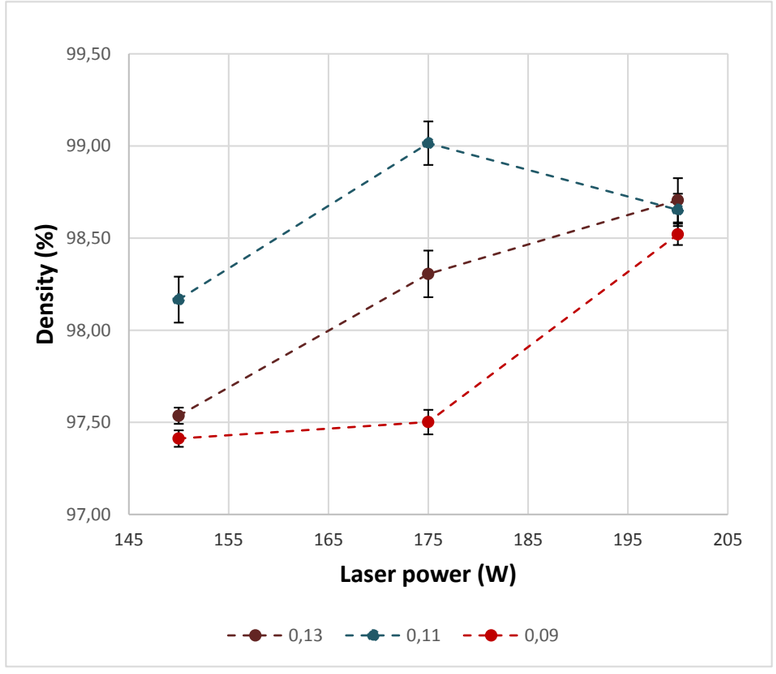
Research

To investigate the opportunities of SLM to create geometries and cooling channels, a Renishaw AM 250 3D-printer was used to print several test channels and geometries in stainless steel (316L). Based on literature the process parameters laser power, print direction and scan spacing were varied around the standard parameters to see whether the geometries or material properties can be improved. The results are examined on strength, density and geometrical quality.
In the second part of the research a test product and an injection mould to be produced with SLM are designed by means of numerical simulations and 3D-printing of prototypes.

1. Printed geometries in stainless steel



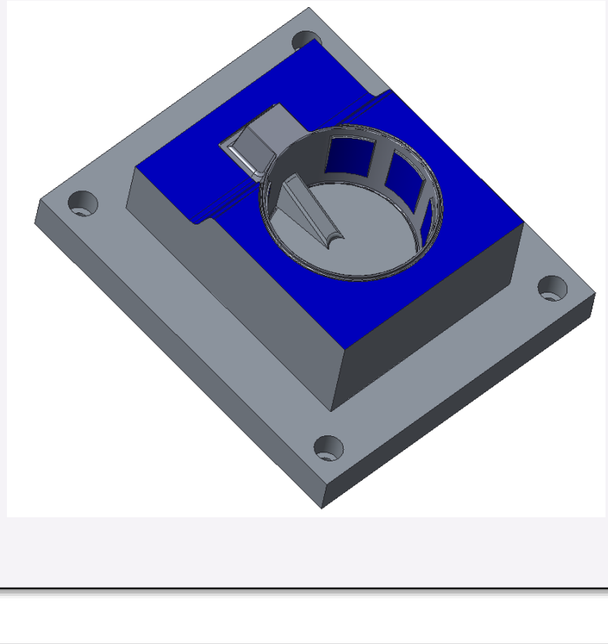
2. Examine properties



3. Printed cup holder as test product

Result

1. **SLM provides the possibility to print different shapes of channels.**
   Different shapes (circular, triangular and square) with diameters up to 9 mm and overhang angles down to 45°.
2. **Interesting properties of printed stainless steel were uncovered.**
   Print direction affects the density and the strength.
3. **The best parameters for production of channels with SLM were found.**
   Standard Renishaw parameters: 200 W laser power and 0,11 mm scan spacing.
4. **A test product and its injection mould were design for future research.**



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