

Determining the influencing factors on the cooling of a 3D printed thermoforming mould

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Abstract.

These days, with the rapid growth of interest in additive manufacturing, packaging industries or researchers have turned their attention to combining a traditional manufacturing process with Fused Filament Fabrication (FFF) to achieve shorter mould manufacturing times and efficiency. Thermoforming is considered one of the oldest technologies for producing plastic products, but the process is highly influenced by the production costs and the overall quality of the mould.

Using a mould produced through Fused Filament Fabrication implies several limitations, such as material selection and the typical process quality. The mould design must respect, at the same time, both the design rules for thermoforming and those for 3D printing. The mould might suffer thermal damage during the thermoforming process because of the low heat transmission of the plastic material.

For the cooling of the mould, a multitude of different approaches and influencing factors can be considered. This paper identifies those factors, and based on statistical DOE (Design of Experiment), adequate experiments have been conducted to analyse the influence of process variables. The critical factors identified and chosen are the mould's material, cooling channels shape and diameter, and the distance from the top surface of the mould to the cooling channels.

The obtained results transformed materialised the paper's objectives in valid conclusions and proposed an optimal configuration design of the mould's cooling system.