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Cobalt Chrome Tools with Conformal Cooling Channels – For High Volume Production with Improved Productivity and Part Quality.



Ing. Paolo Gennaro, President at Protocast S.r.l.



Ing. Ennio Calderara, R&D Manager at BTicino. Ing. Calderara is the driving force behind the use of tools in Cobalt Chrome with conformal cooling channels for BTicino's production of plastic parts.



The Italian company BTicino is an international leader in the design and production of devices for electrical installations. By using Rapid Manufacturing to manufacture injection moulding tools with conformal cooling channels in CoCr, they have been able to improve productivity, reduce cycle time and reduce production cost. By optimizing the cooling system they have also improved the quality of the produced parts.

BACKGROUND

The Italian company BTicino (www.bticino.com), an international leader in the design and production of devices for electrical installations, uses a large number of injection moulding tools in their production of plastic parts. Many of these tool inserts are bought from external toolmakers, but they also have a workshop where they manufacture their own tools.

As part of their efforts to improve productivity and product quality they have been looking for ways to make more efficient

tools with conformal cooling channels. They have therefore tested different Rapid Manufacturing methods and materials to make such tools, often with promising results.

However, a common limitation for these tools has been that they are not able to sustain the wear and tear from the high production volumes typical for BTicino. Many of BTicino's products are produced in millions annually.

The possibility to make tools in Cobalt Chrome, a material with excellent wear and corrosion resistance properties, therefore

offered Bticino the opportunity to manufacture tools with the geometrical freedom and longevity that they require.



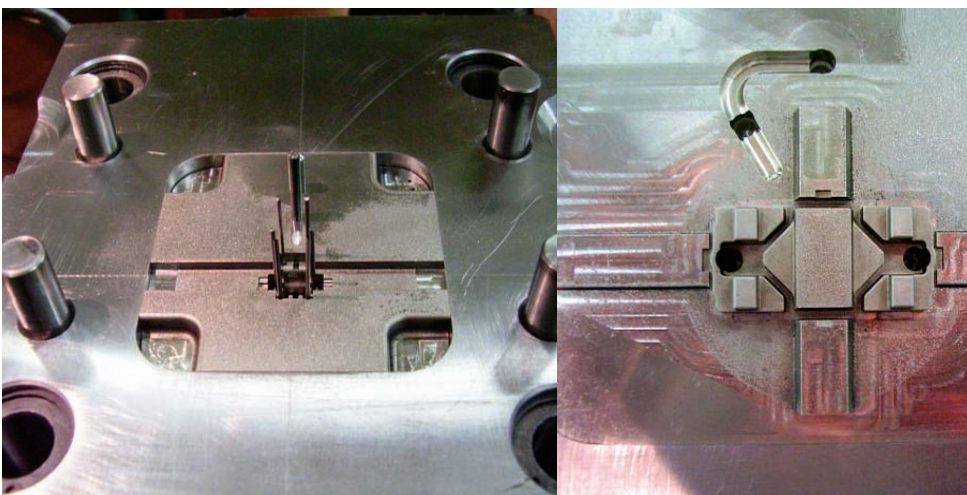
BTicino light switch, in ABS plastic.

ANALYSIS OF THE TOOL

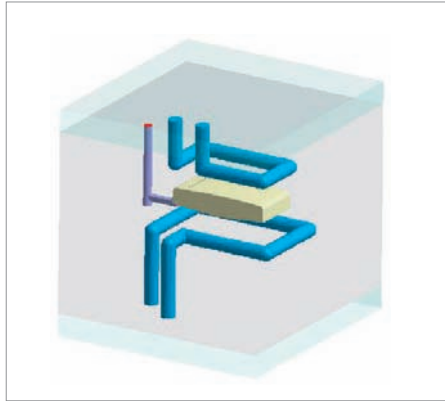
Two other companies came on board to assist BTicino with their project; ProtoCast (www.protocast.it), an engineering company with Rapid Manufacturing expertise and equipment, and Area3 (www.area3engineering.it), an engineering and consulting company with expertise within simulation.

The product chosen for the project was a BTicino light switch in ABS plastic, with a current production volume of 1 million pieces per year.

The first step was to analyse the performance of the (conventional) tool that was used to produce this part, by studying its thermal distribution in order to find a baseline for the efficiency of an improved cooling system.

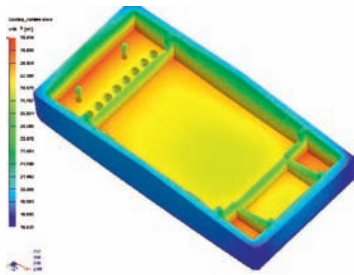


Cobalt Chrome tools with conformal cooling channels, in production in injection moulding machines at BTicino.



Typical cooling channels, in tool manufactured with conventional methods.

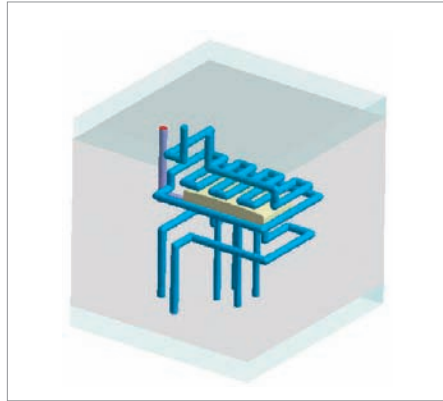
A simulation showed an uneven temperature distribution in the tool and the part, indicating that the standard configuration of the cooling channels left room for improvement.



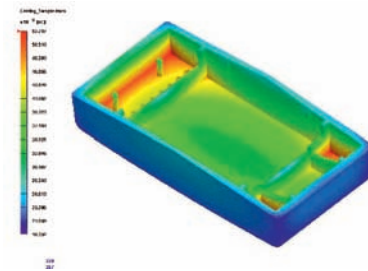
Simulation of temperature distribution, part manufactured in tool with standard cooling channels.

The project therefore went on to study and simulate other possible configurations of the cooling channels.

A number of alternatives were investigated, before the project team decided on the configuration that would be used when the new tool was manufactured.



Hypothetical conformal cooling channel configuration, in tool manufactured with Rapid Manufacturing.



Simulation of temperature distribution, part manufactured in tool with conformal cooling channels.

PRODUCTION OF THE TOOL

The Rapid Manufacturing technology that was selected to produce the tool was Electron Beam Melting (EBM), and the material of choice was a Cobalt Chrome (CoCr) alloy with high resistance to abrasion and chemical corrosion.

The tool was built overnight in an EBM S12, taking advantage of the EBM technology's ability to melt large amounts of material in a short time, due to the high power available in the electron beam gun.

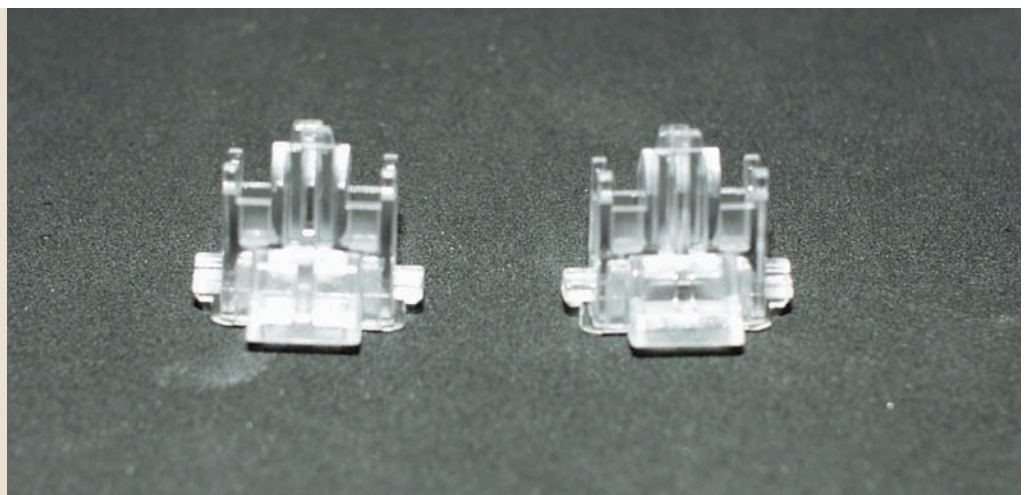
The fully dense tool was then finished by a combination of CNC machining and spark erosion, polished to an optical surface finish, and put into production in one of BTicino's injection moulding machines.



The Arcam EBM S12.

CoCr TOOL, MATERIAL AND PRODUCTION DATA

MECHANICAL PROPERTIES	ARCAM CoCr	ASTM F75 REQ.
Rockwell hardness	43 HRC	25-35 HRC
Yield strength (Rp 0,2)	600 MPa	450 MPa
Ultimate tensile strength (Rm)	900 MPa	655 MPa
Build time	14 h	
Material use	4 kg	
Material cost	180 €/kg	

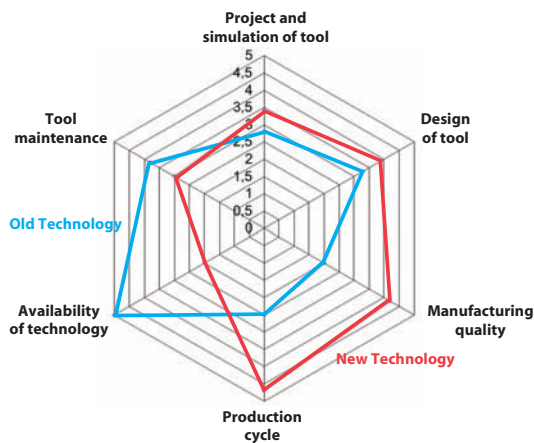


RESULTS

The project's objective was to reduce the injection moulding cycle time and improve the quality of the produced part by optimizing the tool's cooling system. Two tools were compared, one made with traditional technologies and one built with Rapid Manufacturing. The first results obtained from the production were:

Production cycle time	- 35%
Production cost	- 30%
Productivity	+ 50%

Comparison, tool manufactured with conventional and with Rapid Manufacturing technologies.



Moreover, the improved control of the temperature in the tool also resulted in improved part and surface quality (often referred to as "dirtability").

Cobalt Chrome tool with conformal cooling channels, in production in an injection moulding machine at BTicino.



Encouraged by these positive results BTicino have ordered additional CoCr tools with conformal cooling channels. These tools are also used in their production, manufacturing different types of products and in other materials. The time it takes to design a new tool, manufacture and have it in full production is typically less than one week.

CONCLUSIONS

The project verified that optimizing the cooling system in a tool can result in substantial improvements in productivity and part quality.

Furthermore, by using the appropriate Rapid Manufacturing technology and materials it is possible to manufacture tools with conformal cooling channels that are able to sustain the rigors of high volume series production.

The project team continues their work to find new ways to further optimize the cooling system and production of the tools.

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REFERENCES

Gennaro, P & Giorgetti, P. (2006).
Stampi con canali di condizionamento conformali ad alta efficienza,
Congresso TMP 2006, Milan, Italy



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