POLITECNICO MILANO 1863

DIPARTIMENTO DI MECCANICA

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Founded research by ALESSIOHITECH

Design of moulds for expanded polymers by Additive Manufacturing

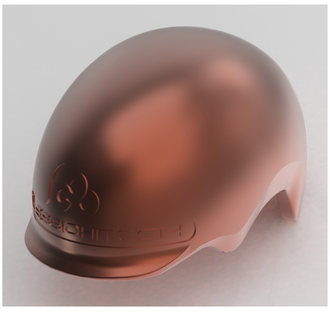
Additive manufacturing approaches are used for the design of moulds for expanded materials to improve the energy efficiency and the sustainability of the whole process.

Introduction

Energy efficiency and sustainability are the future keywords of any industrial process and they define the way to follow for the innovation both of products and processes. For this reason the introduction of technologies focused on the reduction of the energy waste is today the main challenge for the research and the industry.

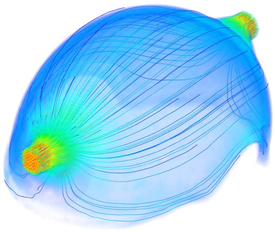
Metal Additive Manufacturing (AM) offers new opportunities for the design of moulds and dies with improved performance and new functionalities. Conformal cooling channels can be easily integrated into dies and increased freedom in shape generation is made available.

By AM a faster, more flexible and sustainable processing route becomes available for the tooling industry. A joint research was therefore undertaken to develop a new generation of moulds for expanded polymer parts, aimed at achieving reduced energy consumption during production and faster processing cycles so as to bring remarkable competitive advantages over the traditional processing tools for the moulding of expanded foams.



Rendering model of the Helmet.

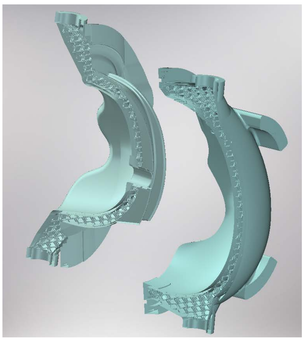
Activities



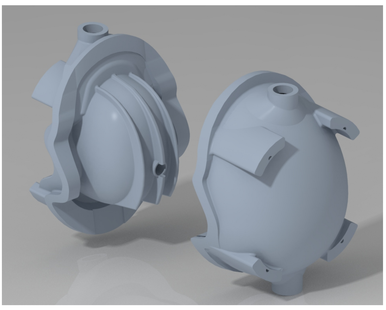
Computational Fluid Dynamics of the fluid flow in the "female" mould chamber.

In order to reduce processing cycles, a lower mould mass and a more efficient heating/cooling system should be designed. With this objective, a new generation of moulds produced by AM routes have been developed.
The moulds feature conformal heating and cooling chambers and low wall thickness, with improved stiffness induced by the use of 3D internal lattices.

The design of the mould shape has been developed and improved by means of computer aided tools. The flows of heating vapour and cooling water have been optimized by fluid dynamic simulations. The stiffness and strength of the mould under service loads have been simulated by FEM in order to avoid failures.



Stereolithography models of helmet moulds.



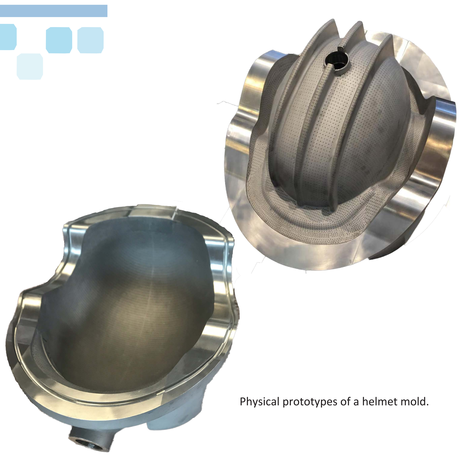
Computer Aided Design models of the helmet moulds.

Results

Advanced metal additive manufacturing techniques are successfully adopted to design and manufacture innovative moulds for EPS, EPP, ETPU and all other expanded traditional and innovative foams.

The research demostrates that by taking advantage of the use of AM technique it is possible to improve the moulding technology reducing costs and saving energy. By providing extensive joint research efforts at Politecnico di Milano and at ALESSIOHITECH, technical challenges have been faced and a new paradigm for mould design and for the energetic improvement of the moulding technologies has been proposed.

The acquired know-how is now available for the introduction into the market of a new generation of energy-efficient and sustainable moulds for expanded polymers.



Physical prototypes of a helmet mold.

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