Additive Manufacturing Process Simulation to Optimise Diecasting Tooling

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ABSTRACT

The innovation of design for diecasting tooling is significantly affected by Additive Manufacturing (AM) technology evolution as well as by the increased reliability of AM process simulation [3]. The casting process simulation is a well-known standard design procedure to optimize the thermal state regime of each part of the steel die taking into account the limitation of traditional machining process to produce the insert with proper cooling channels [1,2]. The advent of Selective Laser Melting (SLM) or Electron Beam melting (EBM) is opening to free form of cooling channels to control the thermo mechanical behaviour of the steel tooling improving the die life and reducing the risk of local defect in the casting. Further innovation is the application of DED to reparation of the High pressure die casting (HPDC) tooling. The AM simulation tools can simulate all different additive processes and various virtual scenarios can be evaluated. The Optimization of diecasting tooling is living a new era thanks to material, technologies and virtual simulation tool of AM processes.

The study described in this paper is a reference application of HPDC and AM simulation coupling the benefits of the two manufacturing processes. The thermo-mechanical performance of traditional diecasting insert is improved by conformal cooling channels and the cycle time is typically minimized. The SLM simulation validates the 3D printing of steel material taking into account the geometry compensation, the support optimization and the quality of printed part to be treated and machined.

The cost- benefits analysis supports the decision in the design phase validating the optimal geometries for the production of the components, verifying the efficiency of the cooling channels designed to support the quality of the component and the dies life, maximizing the benefits and reducing costs [4].

Keywords: process simulation, additive manufacturing, steel insert, conformal cooling, high pressure die casting

REFERENCES