

Investigation on the Cooling Performance of Cooling Channels Fabricated via Selective Laser Melting for Injection Molding

Authors : Changyong Liu, Junda Tong, Feng Xu, Ninggui Huang

Abstract : In the injection molding process, the performance of cooling channels is crucial to the part quality. Through the application of conformal cooling channels fabricated via metal additive manufacturing, part distortion, warpage can be greatly reduced and cycle time can be greatly shortened. However, the properties of additively manufactured conformal cooling channels are quite different from conventional drilling processes such as the poorer dimensional accuracy and larger surface roughness. These features have significant influences on its cooling performance. In this study, test molds with the cooling channel diameters of $\varphi 2$ mm, $\varphi 3$ mm and $\varphi 4$ mm were fabricated via selective laser melting and conventional drilling process respectively. A test system was designed and manufactured to measure the pressure difference between the channel inlet and outlet, the coolant flow rate and the temperature variation during the heating process. It was found that the cooling performance of SLM-fabricated channels was poorer than drilled cooling channels due to the smaller sectional area of cooling channels resulted from the low dimensional accuracy and the unmolten particles adhered to the channel surface. Theoretical models were established to determine the friction factor and heat transfer coefficient of SLM-fabricated cooling channels. These findings may provide guidance to the design of conformal cooling channels.

Keywords : conformal cooling channels, selective laser melting, cooling performance, injection molding

Conference Title : ICAMTA 2019 : International Conference on Additive Manufacturing Technologies and Applications

Conference Location : Tokyo, Japan

Conference Dates : May 27-28, 2019