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Investigation on conformal cooling system design in injection molding

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ABSTRACT

Most advanced technologies developed nowadays focus on issues such as minimizing manufacturing cost and improving product quality. Cooling system design is one of the most critical factors to reduce cycle time. Conformal cooling is the concept which can reduce cooling time and improve product quality as well. However, cooling system layout is restricted by traditional molding method. For cavities with irregular geometry, the distance between cooling channels and cavity may vary throughout the part. This causes local heat accumulation and some product defects such as sink mark and warpage. By using some non-conventional methods such as laser sintering, cooling channels can get closer to the cavity surface than using traditional method. This leads to a shorter cooling time. The current study uses a true three dimensional simulator to predict cooling time and compare the results from a conventional and a conformal cooling design. The results also show flow behavior inside cooling channels which provide important indices for cooling system design revision. With a shorter cycle time and an improved product quality, conformal cooling has a great potential in injection molding industry.

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References

[1] Dalgarno, K.W., Stewart, T.D. (2001). Manufacture of production injection mould tooling incorporating conformal cooling channels via indirect selective laser sintering, *Proceeding of the institution of mechanical engineers*, Vol. 215, part B, 1323-1332.
[2] Sachs, E., Wylonis, E., Allen, S., Cima, M., Guo, H. (2000). Production of injection molding tooling with conformal cooling channels using the three dimensional printing process, *Polymer Engineering and Science*, Vol. 40, No. 5, 1232-1247.
[3] Mayer, S. Optimized mould temperature control procedure using DMLS, EOS whitepaper, EOS, from *http://www.compositesworld.com/*, accesed June 20, 2012.
[4] Li, C.L. (2001). A feature-based approach to injection mould cooling system design, *Computer-Aided Design*, Vol. 33, No. 14, 1073-1090, doi: 10.1016/S0010-4485(00)00144-5.
[5] Au, K.M., Yu, K.M. (2007). A scaffolding architecture for conformal cooling design in rapid plastic injection moulding", *The International Journal of Advanced Manufacturing Technology*, Vol. 34, No. 5-6, 496-515.
[6] Park, H.S., Pham, N.H. (2009). Design of conformal cooling channels for an automotive part, *International Journal of Automotive Technology*, Vol. 10, No. 1, 87-93.
[7] Au, K.M, Yu, K.M., Chiu, W.K. (2011). Visibility-based conformal cooling channel generation for rapid tooling, *Computer-Aided Design*, Vol. 43, No. 4, 356-373.
[8] White, F.M. (1991). *Viscous fluid flow*, 2nd ed., McGraw Hill, New York.