TE Connectivity : Team Heat OP Project Recap

TE connectivity designs and manufactures electronic connectors, components and systems for a variety of industries. Injection molding is viewed as one of their most vital operations and manufacturing process for mass production of high quality plastic parts for connectors. There are about 20 injection molding machines at TE’s Lickdale production facility, which produces plastic products with conventional reciprocating screw injection system using steel molds. The current cycle time for TE injection molding process is approximately 20 seconds, during which cooling time alone takes up 14 seconds. This constitutes about 70% of the entire cycle time. The objective of the project is to develop a more effective heat transfer processes to reduce cooling time by 10% in the injection molding process. Concurrently, the solution is required to add no operation safety hazards, and has to be cost effective.

Interdisciplinary literature research was conducted in four topics: using high thermal conductivity novel materials, installing cooling fins, adding a forced convection system and replacing water coolant with high thermal conductivity nanofluids. Based on the concept selection matrix, using high thermal conductivity novel materials was the best design for the team to pursue further. Using Solidworks Heat Transfer Simulation, the team performed simulations for 4 novel materials and a 1 simulation using stainless steel, a material currently being used by TE, as a benchmark. The purpose of the simulation is to find out the cooling time of injected plastic from 700K to 383K for selected novel materials and the results are presented as temperature profiles as shown in Figure 1.

The 14 seconds cooling time of stainless steel mold was used as a benchmark. All four selected novel materials have significantly shorter cooling time than stainless steel. The best cooling times result from SuperKFC and FusTHERMO, which were able to reach the 383K benchmark in 1 second. However, the recommendation material determined by the team is COLSIBRO, a copper nickel silicon alloy, due to its high thermal conductivity, high hardness, and availability in the current market. COLSIBRO can improve cooling time by 88%, which far exceeds the team’s initial goal. This reduction in cooling time is estimated to save TE Connectivity Lickdale production facility around 5 million dollars per year in production cost.

Figure 1. Temperature Profile of Plastic Part in COLSIBRO Mold