

Improved thermal management

Beyond cost and time reduction, some methods of rapid tooling offer a potential benefit of improved thermal properties that cannot be realized with conventional machined tools. One such beneficial method is to create conformal cooling channels within the tooling. The following photograph shows a mold insert with part of its corner cut away, revealing the conformal cooling channel. These channels allow coolant to pass through the mold in a pattern that conforms to the shape of the mold cavity. Conformal cooling removes heat from the mold or die faster than the straight-line channels in machined tools, which can reduce cycle times. Tests suggest that conformal cooling can reduce cycle time by 20%, improve part quality, and have a significant impact on part cost and production rates.

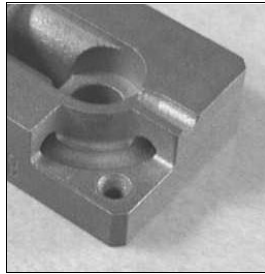


Photo of conformal cooling channel, courtesy of EOS

Ray Mueller of Mueller Machine & Tool (St. Louis, Missouri) explained that his company completed a tool using conformal cooling and achieved almost unbelievable results. The shape of the part (see the following photograph) made it impossible for conventional cooling channels to easily cool the mold, so injection cycle time was very slow. Using spiral conformal-cooling lines, cycle time dropped by an astonishing 10 times. This was the first time that Mueller had tried conformal cooling, so he was immediately sold on the concept.



Photo of a plastic part that was molded with spiral conformal-cooling lines, courtesy of Mueller Machine & Tool

Another method of thermal management is the use of functionally graded materials. The idea is to use a hard, resistant material, such as H13 tool steel, for the tooling surface, and a highly conductive material, such as a copper alloy, for much of the remainder of the mold. Optomec and POM have successfully produced molds and dies with a copper core. With conventional straight-line cooling channels, this tooling reduced cycle times by 15–25%. When combining this concept with conformal cooling channels, it is believed that it could reduce cycle time by up to 35%.