

FIMMTECH, Inc.

Frontier Injection Molding and Material Technologies, Inc.

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ESTABLISHING A ROBUST INJECTION MOLDING PROCESS, PART 5:

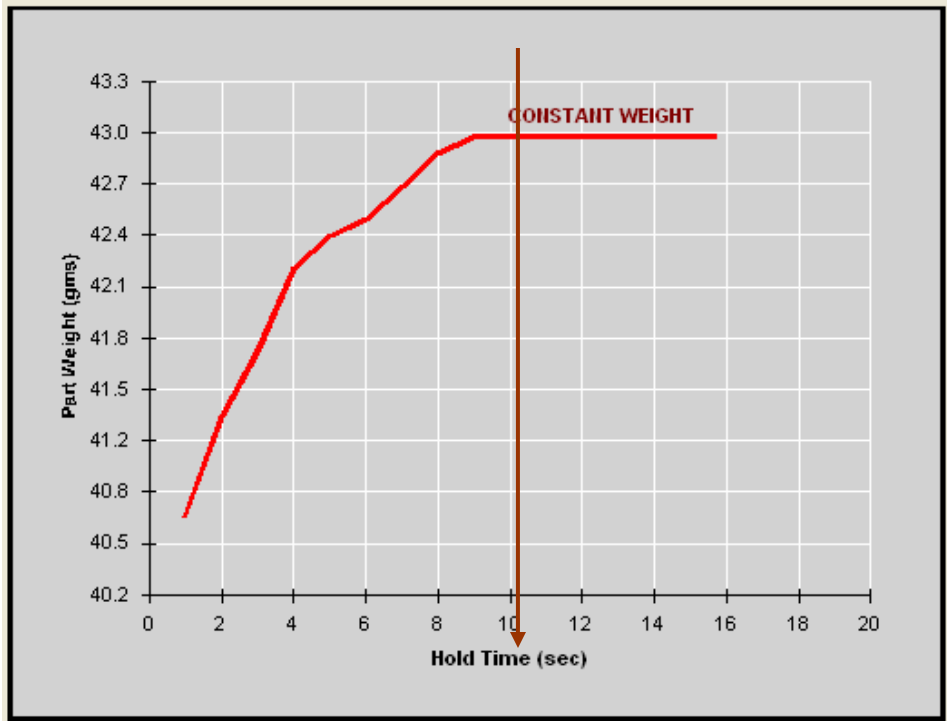
THE HOLDING PHASE - Time.

Introduction to Holding Time:

The holding pressure must pack into the cavity, the plastic equivalent to this volumetric shrinkage that occurs during the cooling down of the plastic as it hits the cold walls of the mold. The plastic enters the cavity through the gate. As long as the gate is not frozen, the plastic can enter the cavity or leave the cavity. The holding pressure must therefore be applied till the gate is frozen. This is where the time factor gets into the picture. If enough time is not given, two of the following can happen. First, enough plastic will not get into the cavity and second, the plastic inside the cavity which is under high pressure will come out of the cavity. It is therefore imperative that the time for which the holding pressure is applied is enough to freeze the gate of the part.

A very simple study is performed to determine this time. Samples molded with different holding times are weighed and the time after which the weight remains constant is set as the holding time. As the holding time is increased more and more plastic enters the cavity increasing the weight. But as soon as the gate is frozen, the plastic cannot get into the cavity and the part weight remains constant. This is called the gate freeze time or the gate seal time. See the picture on the next page.

You will notice that the part weight remains constant after 9 seconds. The holding time is set to one second higher than the gate seal time to ensure that the gate is frozen during every shot. In the case of the graph below the time was set to 10 seconds. This will ensure consistency and any small variations will be compensated for.



Procedure for determining the Hold Time.

1. Set the injection speed to the value obtained from the viscosity curve experiment.
2. Set the process at the center of the process window from the process window study.
3. Set the cooling time to a value to ensure that the part is cooled before ejection.
4. Drop the holding time to zero and start molding. Mold approximately 5 to 8 shots.
5. Increase the holding time to one second and collect a shot.
6. Increase the holding time to two seconds and collect a shot. Similarly collect shots at increments of one second.
7. Weigh the shots and plot a graph of part weight versus time similar to the graph in the picture.
8. Determine the gate seal time.

How to use this information:

Once the graph is generated, choose your holding time, such that you are just beyond the time where the part weight is constant. In the above graph, the part weight is constant after 8 seconds. Set the holding time to 9 seconds.

About FIMMTECH:

FIMMTECH is a consulting firm that provides services in the area of Injection Molding of Plastics. FIMMTECH is also in the process of developing products that will increase efficiency of the molding process, educate personnel and better manage the molding facility. One of the first products to be released is the software 'NAUTILUS' that helps in the development of robust and optimized processes. Suhas Kulkarni also teaches a course on Injection Molding at the University of California, San Diego that can be offered as In-House seminars. For more information please visit www.fimmtech.com

Thank You.

Sincerely

Suhas Kulkarni.