The Performance of Impact Micro-injection Molding

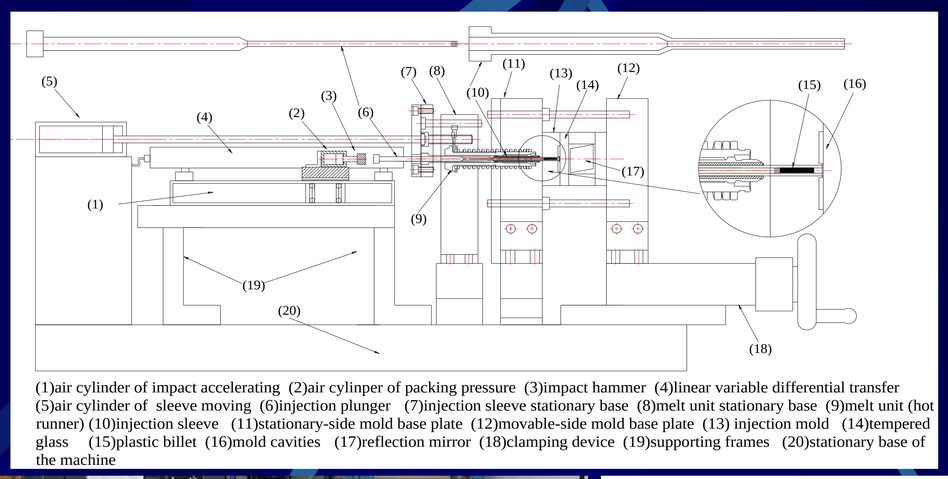
S.C.Nian(1) and S.Y. Yang(2)

(1) Department of Mechanical Engineering, Dahan Institute of Technology, Haulian, Taiwan

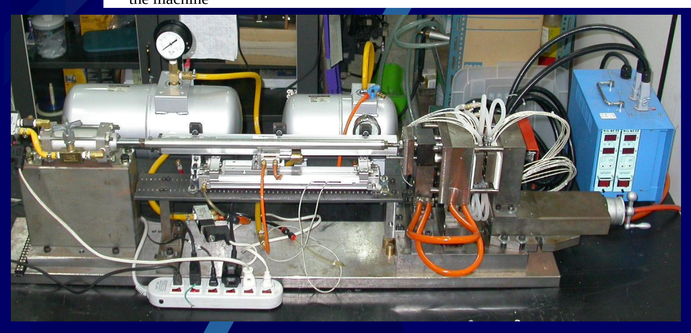
(2) Department of Mechanical Engineering, National Taiwan University, Taipei, Taiwan

Abstract

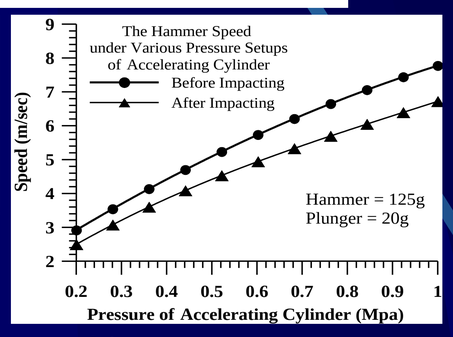
In this study, a lab-made impact type micro-injection machine was developed and used. The micro-injection molding machine can achieve an impact speed of 6500 mm/s. The conditions of flow length, injection pressure, and shear rate during impact micro-injection molding process are investigated systematically with aid of spiral cavity, flow visualization system, and computer simulation. The first part of this study presents the design concept, construction and characteristics of the impact micro-injection machine. The second part investigates the effects of the processing conditions on the spiral flow during the impact micro-injection molding process.

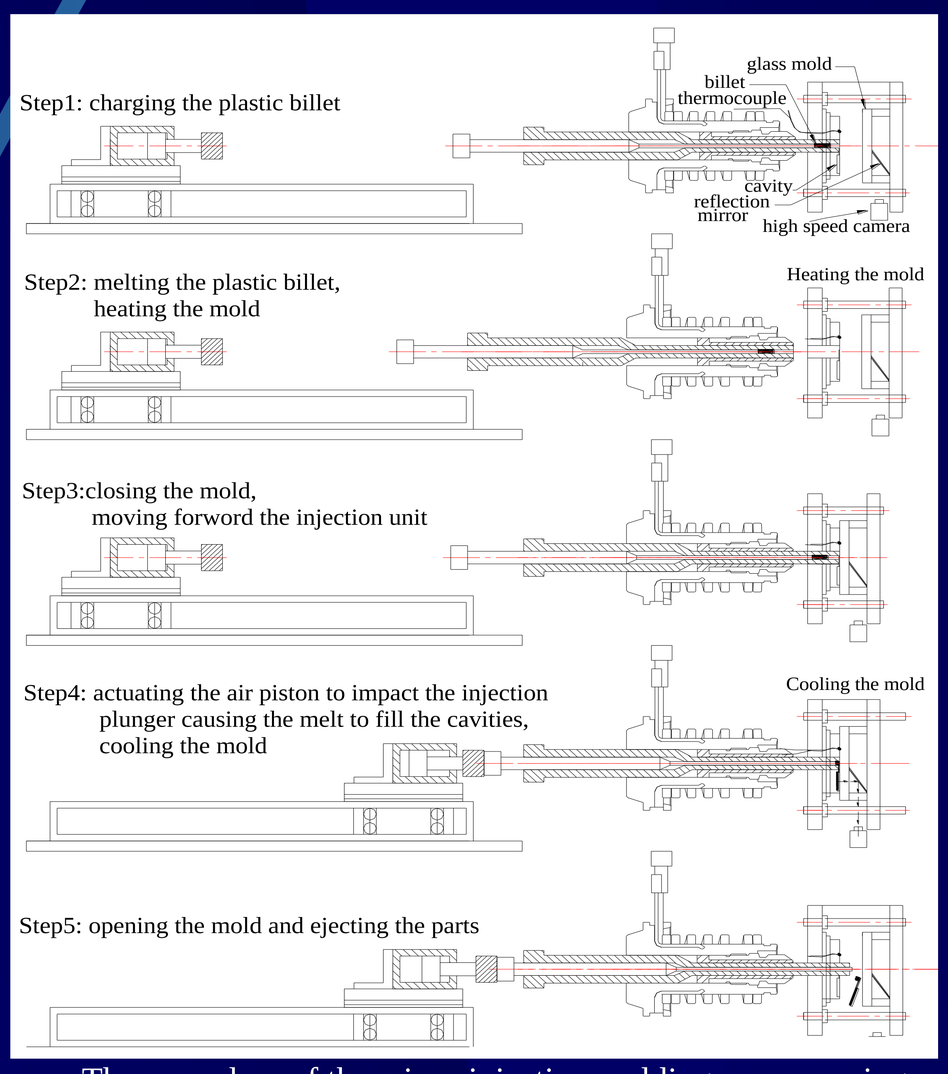


(1)air cylinder of impact accelerating (2)air cylinper of packing pressure (3)impact hammer (4)linear variable differential transfer (5)air cylinder of sleeve moving (6)injection plunger (7)injection sleeve stationary base (8)melt unit stationary base (9)melt unit (hot runner) (10)injection sleeve (11)stationary-side mold base plate (12)movable-side mold base plate (13) injection mold (14)tempered glass (15)plastic billet (16)mold cavities (17)reflection mirror (18)clamping device (19)supporting frames (20)stationary base of the machine



The impact type micro-injection machine

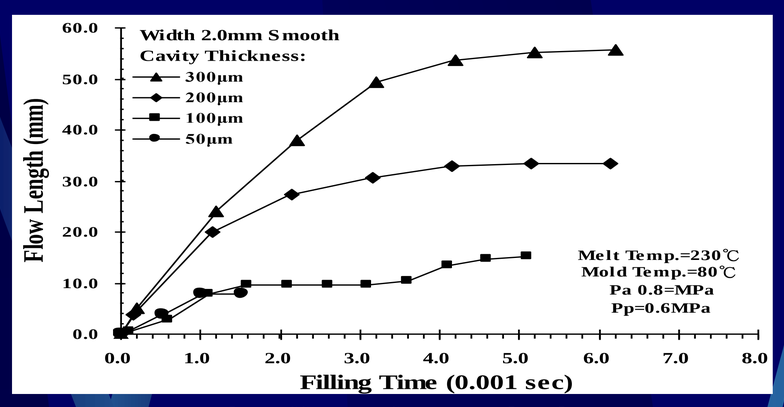




The procedure of the micro-injection molding process using an impact type micro-injection molding machine

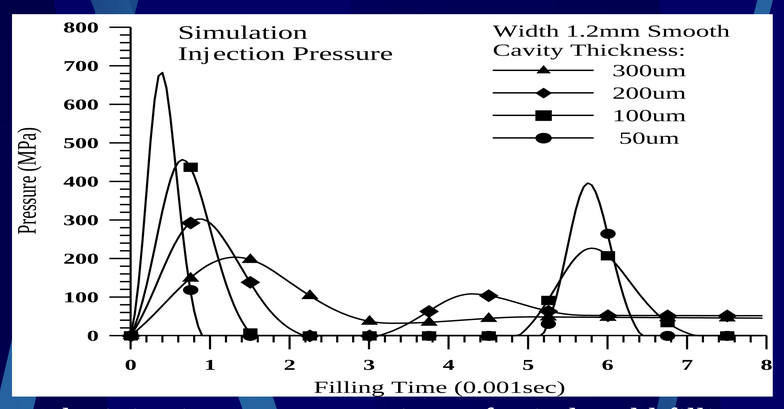
The dimensions of the spiral mold

Results and Discussion



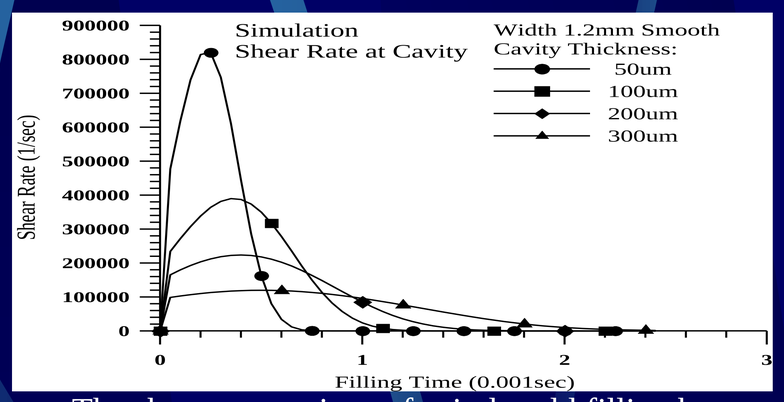
The effects of cavity depth

The deep cavity indicates longer flow length and filling time .



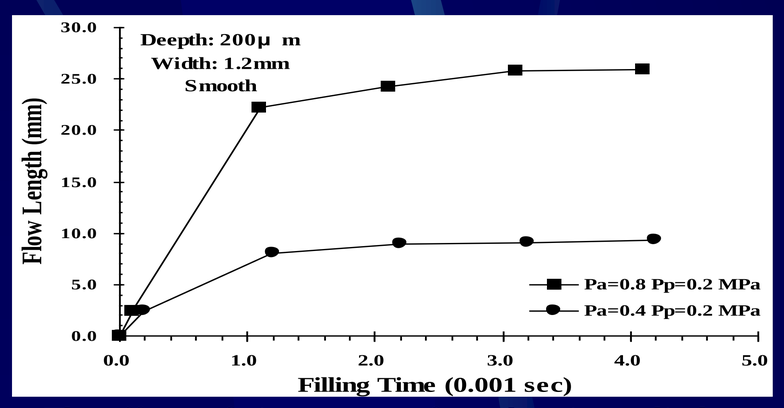
The injection pressure various of spiral mold filling by computer simulation

The deep cavity indicates less injection pressure.



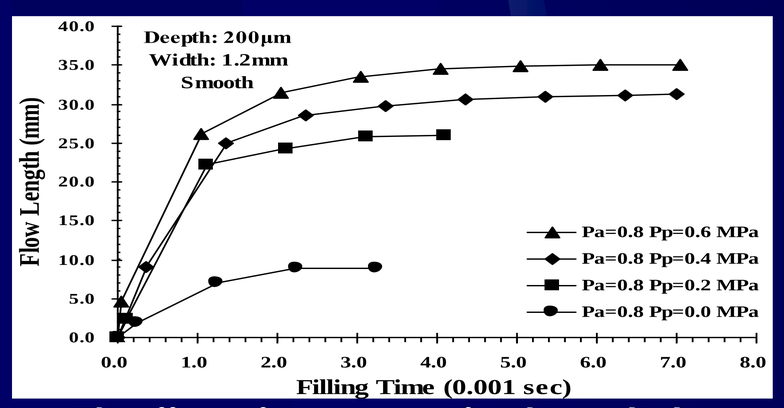
The shear rate various of spiral mold filling by computer simulation

The deep cavity indicates less shear rate.



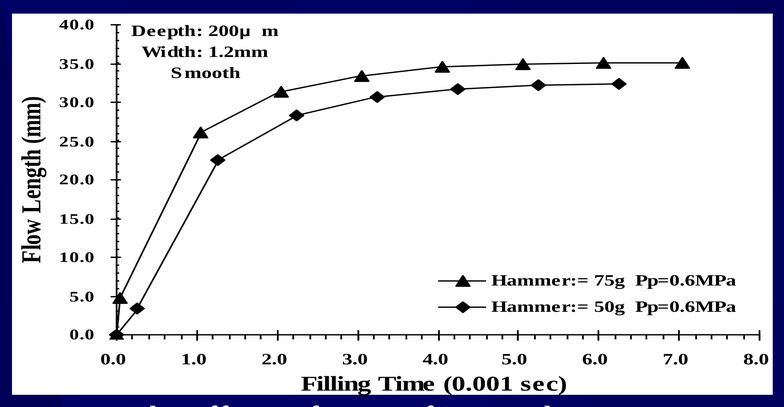
The effects of air pressure of accelerating cylinder

The larger air pressure of accelerating cylinder will have larger impact speed and result in larger impact energy, therefore, has faster filling speed and flow length at the impact moment.



The effects of air pressure of packing cylinder

The increase of air pressure of packing cylinder will not have significant effect in the impact-filling stage, but will elongate the melt flow length and flow time in the pressure-filling stage .



The effects of mass of impact hammer

The larger mass of impact hammer will have larger impact energy and result in faster filling speed and flow length in the impact-filling stage, but almost without any effect on the pressure-filling stage.

Conclusions

In this study the design concept of the impact micro-injection machine and the effect of processing parameters are investigated. Following conclusions can be drawn: 1. The deep cavities have longer flow length and filling time, and less injection pressure and shear rate. 2. The larger air pressure of accelerating cylinder will has faster filling speed and flow length at the impact moment. 3. The increase of air pressure of packing cylinder will not have significant effect in the impact-filling stage, but will elongate the melt flow length and flow time in the pressure-filling stage. 4. The larger mass of impact hammer will result in faster filling speed and flow length in the impact-filling stage, but almost without any effect on the pressure-filling stage.