AENSI Journals

Australian Journal of Basic and Applied Sciences

ISSN:1991-8178

Journal home page: www.ajbasweb.com

Simulation Of Plastic Fill Pattern Validation In Injection Molding

U.M. Zulkifli, S. Zainal Ariffin, Mohd A.

Faculty of Manufacturing Engineering Technology, TATI University College, 24000, Terengganu, Malaysia

ARTICLE INFO

Article history:
Received 20 November 2013
Received in revised form 24 January 2014
Accepted 29 January 2014
Available online 5 April 2014

Keywords:
Simulation,filling,shot size

ABSTRACT

The use of simulation software is very important in molding industry to predict the product quality and process ability. This paper presents the filling simulation with actual injected part by using edge gate. The objective of this paper is to predict the accuracy of simulation software with actual injection molding by setting up shot size with variables size of stroke positions. The experiment component of key holder is designed by using CAD software and simulated with MoldFlow Plastic Insight 2010-R2 to achieve the parameter setting for injection molding machines. Edge gate system is used to verify the product quality by injected with Polypropylene resins.The results showed that data provided by software is very useful for parameter setting in injection molding machine which can reduce time of mold setup and this validation can eliminate the try out stage in production line

To Cite This Article: U.M. Zulkifli, S. Zainal Ariffin, Mohd A., Simulation Of Plastic Fill Pattern Validation In Injection Molding. ***Aust. J. Basic & Appl. Sci.,*** *8(4): 833-836, 2014*

INTRODUCTION

Nowadays, the process of trial and errors required at the tryout stage can be reduce through the CAE by simulation resin flow pattern and predicting defects that can be avoided by improving flow balance (S. S. S. Imihezri *et al*., 2004). Shen *et al*., 2001 used the MoldFlow software to simulate the cases for thin-wall injection molding of fiber reinforced thermoplastics. Their study used the different processing parameters to discuss optimal result.

Hetu *et al*., 1998 studied a 3D finite element method for simulation of the filling stage in molding for industrial part. This is important for obtaining the optimum molding conditions. Choi *et al*., 2004 presented a method for optimizing process parameters of injection molding with Neural Network application in the process simulation environment. They are developing learning system to generate optimum set of process parameter at design stage with minimum number of CAE runs.

Without filling analysis, it is difficult to perform proper optimization. Design by experience, widely used in the past, is strictly related to decisions, both good and bad, taken by skilled personnel basing on previous production information (R. Malloy, 1994).

2. Gate design:

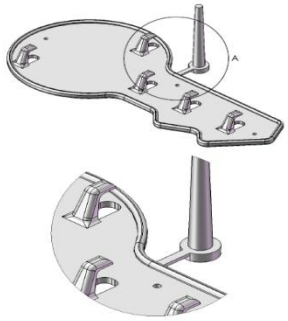
Edge gate system used for this component for two-plate mold system as shown in Fig. 2. Edge gate system as shown in Fig. 2(a) is the most types of gate being used because of it's easy to fabricate but need sufficient injection pressure to prevent gate area from freeze which will affect the flow of melting material entering into cavity.

RESULT AND DISCUSSION

Setting Shot Size:

Shot size is equal to the volume (weight) of molten resin injected by the screw during the molding cycle. Normal practice,the actual shot size should be between 10% and 70% of the machine rated capacity. When inject new part molding, always begin with short-shots, then gradually increase the shot size until all part cavities are 80-90% filled. This procedure can minimize the potential for overpacking and prevent flash of the part. The screw position should be noted and used to set the transfer point. After the gate freezes, any additional material volume or pressure will just pack the sprue and runner system, which can cause difficulties with sprue removal during part ejection.

Corresponding Author: U.M Zulkifli, Department of Tooling, Faculty of Manufacturing Engineering Technology, TATI University College, 24000 Terengganu, Malaysia.
E-mail: zul@tatiuc.edu.my



(a)

Fig. 1: (a) Edge gate.

Processing Parameter:

Molding quality produced by the injection molding is always affected by the process parameters like injection pressure, melt temperature, mold temperature, packing pressure, etc. Chen *et al*., 2008 stated these molding variables give effect on the physical and mechanical properties of thermoplastics. Song *et al*., 2007 had applied the orthogonal experiment of Taguchi method and simulation software by using Moldflow which is discussing the influence of different process parameters.

The process parameters setting for the experiment are injection pressure, melt temperature, mould temperature and packing pressure as shown in Table 1.

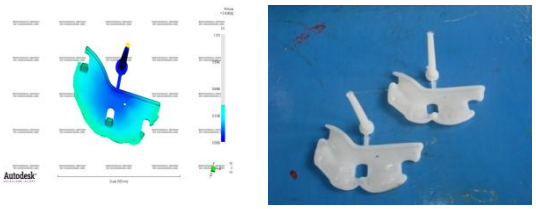
Table 1: Process parameter setting.

Part No.	Injection Pressure	Melt Temperature	Mold Temperature	Stroke Position	Machine Screw Diameter	Packing Pressure
1	20 MPA	240 ° C	40 ° C	10 mm	Ø 32mm	16 MPA
2	20 MPA	240 ° C	40 ° C	20 mm	Ø 32mm	16 MPA
3	20 MPA	240 ° C	40 ° C	30 mm	Ø 32mm	16 MPA
4	20 MPA	240 ° C	40 ° C	35 mm	Ø 32mm	16 MPA

The packing pressure is kept constant at 16 MPa throughout the experiment. Meanwhile the stroke position is set at four different levels which is 10 mm and 35 mm is the smallest and the biggest stroke respectively.

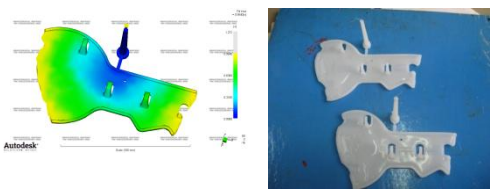
The actual part then is compared with the simulation work as shown in Fig. 2 for edge gate system. The part is half filled when the stroke ram at 20 mm and completely filled when the stroke ram position at 35 mm.

Stroke ram position = 10 mm



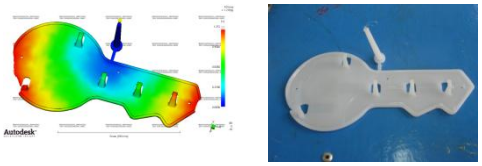
Simulation by MPI **Actual**

Stroke ram position = 20 mm



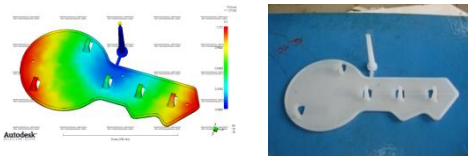
Simulation by MPI **Actual**

Stroke ram position = 30 mm



Simulation by MPI Actual

Stroke ram position = 35 mm



Simulation by MPI Actual

Fig. 2: Result of stroke position for edge gate.

Result on Fig. 3 showed the actual part with edge gate profile. Prediction from software to actual molding is very helpful for production line.

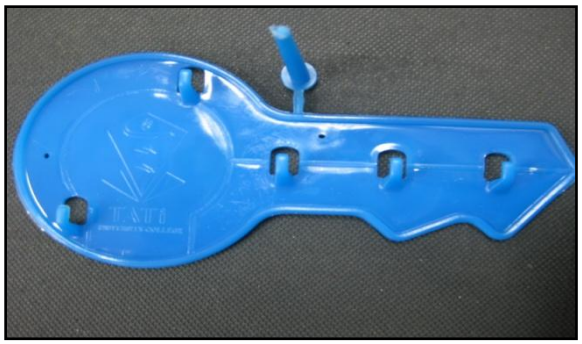


Fig. 3: Actual molding part.

Conclusion:

Prediction from the simulation software is very useful to determine the setting parameter in injection molding machines. This will helps for actual injection setting process, reduce production time,trial practice and modification of mold. Simulation validation is very helpful for economy solution because molding products quality will rely on the correct parameter on the injection machines. It is actually influences the manner of plastic flow into the cavity which can improves quality of part and eliminates the products defects.

REFERENCES

Chen, W.C., P.H. Tai, M.W. Wang, W.J. Deng, C.T. Chen, 2008. A neural network-based approach for a dynamic quality predictor in plastic injection molding process. Expert Systems with Applications, 35(3): 843-849.

Choi, G.H., K.D. Lee, N. Chiang, 1994. Optimization of process parameters of injection molding with neural network application in a process simulation environment, Ann. CIRP, 43(1): 449-452.

Hetu, J.F., D.M. Gao, A. Garcia-Rejon, G. Salloum, 1998. 3D finite element method for the simulation of the filling stage in injection molding, Polym. Eng. Sci., 38 (2): 223-236.

Imihezri, S.S.S., S.M. Sapuan, M.M.H.M. Ahmad and S. Sulaiman, 2004. "A study of the comparison of 'V' and 'X' ribbing in a composite pedal using mold flow analysis software," *Material and Design*, 26: 157-166.

Malloy, R., 1994. Plastic Part Design for Injection Moulding: An Introduction, Hanser Publishers, Munich, Germany, pp: 127-130. ISBN 1- 56990-129-5.

Shen, Y.K., P.H. Yeh, J.S. Wu, 2001. Numerical simulation for thin wall injection molding of fiber-reinforced thermoplastics, Intern. Comm. Heat Mass Transf., 28: 1035-1042.

Song, M.C., Z. Liu, M.J. Wang, T.M. Yu, D.Y. Zhao, 2007. Research on effects of injection process parameters on the molding process for ultra-thin wall plastic parts. Journal of Materials Processing Technology, 178(1-3): 148-153.