

Experimental validation of a model for gas-assisted injection moulding simulations

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Experimental validation of a model for gas-assisted injection moulding simulations

Introduction

In *Gas-Assisted Injection Moulding* (GAIM), gas is injected into a mould that is partially filled with polymer. The gas drives the molten polymer core further into the mould until it is filled completely (Fig. 1).

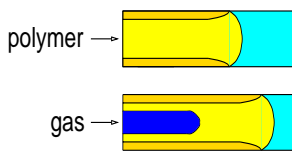


Fig. 1 The GAIM process.

A computational model has been developed to simulate GAIM processes. This model has to be validated experimentally.

Experimental methods

- Gas injection experiments were carried out in two different moulds:

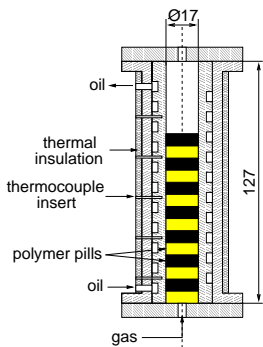


Fig. 2 Cylinder.

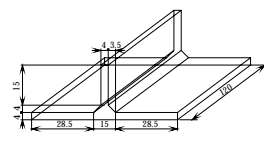


Fig. 3 Plaque-with-rib.

- Polystyrene inserts were placed in the mould and heated to a uniform temperature.
- Nitrogen gas was injected either before or after the mould started to cool down.
- Depending on the shear rate, the polystyrene exhibited either Newtonian or shear-thinning viscosity behaviour.
- After cooling down, the polystyrene specimens were released from the mould. Their polymer skin thicknesses were measured and compared with the simulation results.

Results

Fig. 4 Experimental (left) and numerical (right) gas distributions in cylinder. Top to bottom: Newtonian, shear-thinning, and non-isothermal case. ▶

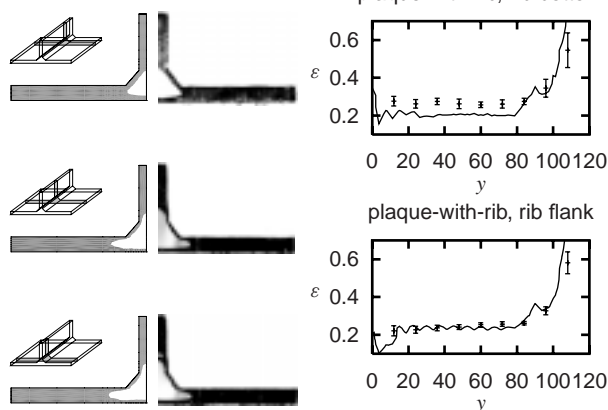
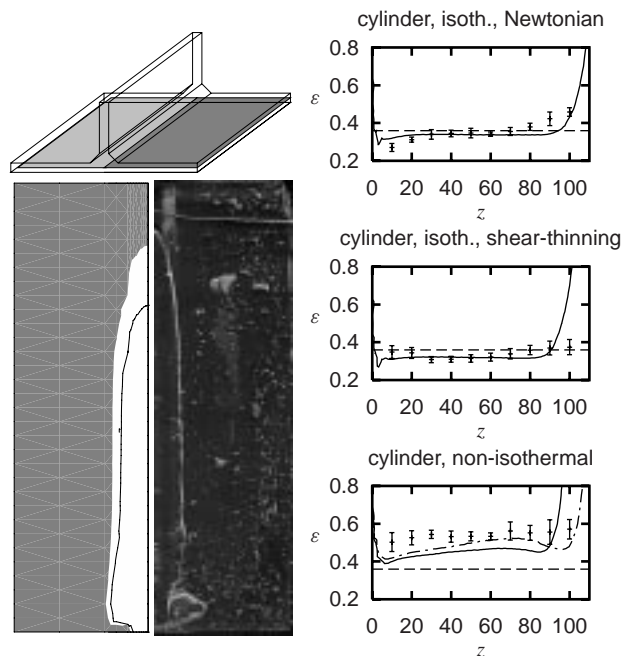


Fig. 5 Numerical (left) and experimental (right) gas distributions in plaque-with-rib cross sections.
Fig. 6 Numerical (lines) and experimental (error bars) residual wall thickness ϵ along cylinder or rib length.

Conclusion

The comparison of gas injection experiments and simulations shows that the developed computational model is able to correctly predict the gas distribution inside a GAIM product.

