

Definition of a process performance index based on gate-distance and incubation time for liquid composite moulding processes design

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Abstract

The success of filling and curing stages in a liquid composite molding (LCM) depends on many variables such as locations of gates and vents, temperature distribution, flow rate, injection pressure, etc. A great challenge to obtain high quality finished parts is to accurately predict flow pattern, and temperature and conversion profiles using simulation for process design optimization. With the predicted process performance measures, the LCM process can be optimized through locating the gates and vents properly.

In this study, a process performance index based on gate-distance and incubation time for liquid composite molding processes is defined. This index allows the consideration of both resin flow and curing issues in process design optimization. Another advantage of using this index in process optimization is that the computation involved is very efficient as only two-dimensional calculation is required. This makes the index very useful in LCM process design optimization where lengthy iterative stochastic search algorithms such as genetic algorithms are used.

In this paper, the new index is used to optimize the resin transfer molding (RTM) process design, considering both resin flow and curing. The effectiveness of the approach is illustrated through a number of examples which involve race tracking, varying permeability areas, different filling conditions, etc.

Keywords: Fixed Mesh Resolution, RTM, Liquid Composite Molding, Optimization