ACTIVE FLOW CONTROL IN A VARTM PROCESS USING LOCALIZED INDUCTION HEATING

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ABSTRACT

Variabilities in preform permeability can lead to the formation of dry spots and nonuniform flow progression during mold filling in the vacuum assisted resin transfer molding (VARTM) process. An approach to improving fill uniformity and eliminating potential fill related defects is the use of a real-time flow control. Flow controls are often based on controlling the inlet pressures or flow rates and have been shown in the literature to be limited in their ability to steer the flow in regions far from the inlet ports. A viable solution to this problem is localized heating of the resin during the mold filling process, which can reduce the local viscosity of the flowing resin to compensate for spatial preform permeability variation. In this paper localized heating is achieved using an induction heater with carbon fiber susceptors embedded in the preform layup. This type of control must be applied to the VARTM process in such a way as to heat in the lagging regions while avoiding overheating and thus prematurely curing the resin. To this end, this paper presents a real time control strategy for localized induction heating of the flowing resin during the VARTM process. This strategy is demonstrated in a lab scale experimental setup, and is shown to be successful in improving the uniformity of the flow during mold filling of heterogeneous preform layups. This increased uniformity will in turn lead to a reduction in void and dry spot formation and improved part quality. Details of the control scheme and results of experimental runs will be presented and discussed.