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ROLE OF FIBER DISTRIBUTION AND AIR EVACUATION TIME ON CAPILLARY DRIVEN FLOW INTO FIBER TOWS

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Abstract

Composite materials are created by reinforcing a matrix material with fibers. In Liquid Composite Molding (LCM) processes, dry fiber preforms are impregnated with resin to form the composite. The fiber preforms usually contain fiber tows and resin impregnation into the tows is driven by the applied pressure gradient and the capillary pressure. The fiber tows are usually less permeable than the regions in between them hence the resin will typically flow around the fiber tows at much faster rate than into them. Due to the dual scale nature of the pore structure, there are often microvoids within fiber tows that result from air and volatiles being trapped. This paper introduces a novel methodology to include both capillary and void pressure in the prediction of tow filling. The methodology allows for addressing the effect of non-uniform fiber volume fraction distributions within the tow on void distribution. The time dependent applied pressure experienced by the tow is also taken into account. The method is used to study the effect of wetting properties and the length of air evacuation time on void entrapment.

Keywords: Process modeling, Liquid composite molding, Resin Transfer Molding (RTM), Vacuum infusion