

REPEATABILITY AND VARIABILITY OF THE AUTOMATED VARTM PROCESS

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OBJECTIVE

Contribution to the Study of VARTM Repeatability

Manufacture VARTM Parts

Evaluate the Sources of Process Variations Affecting the Final Part:

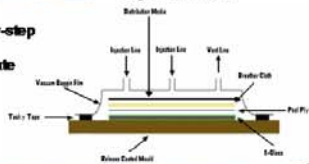
quality - dimensional tolerances - mechanical properties

VARTM OVERVIEW



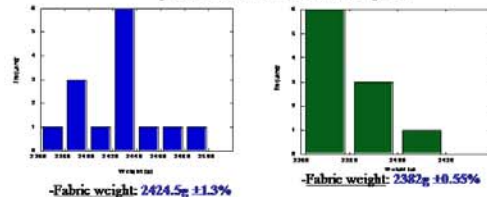
Materials
 24 oz. Woven E-glass, 12"x48"
 Peel Ply, 18"x53"
 Breather Cloth, 12"x50"
 Distribution Media, 11"x49"
 Tubing
 Vacuum Bagging
 Vinyl Ester Resin

- Process**
- manual lay-up (step-by-step guide)
 - automated infusion (gate opening/closing)
 - automating control (vacuum, time)

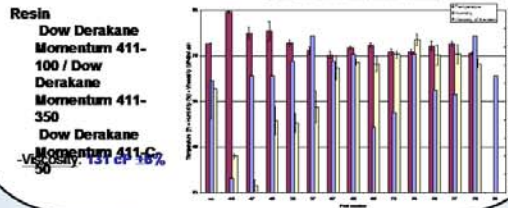


INCOMING MATERIALS VARIATION (1/2)

Fabric: parts made of hand cut layers
 parts made of laser cut layers

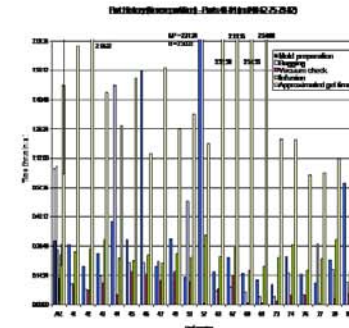


INCOMING MATERIALS VARIATION (2/2)



PROCESS VARIATION (1/2) - LAYUP

Average Mold Preparation Time: 19:52 ± 35.6%
 Average Vacuum Check Time: 7:07 ± 73.6%
 Average Bagging Time: 14:21 ± 81.8%
 Average Infusion Time: 23:25 ± 21.1%

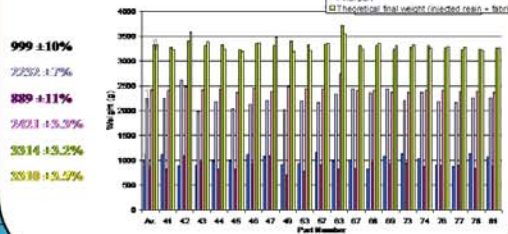


PROCESS VARIATION (2/2) - INFUSION

Records flow behavior temperature and humidity resin weight

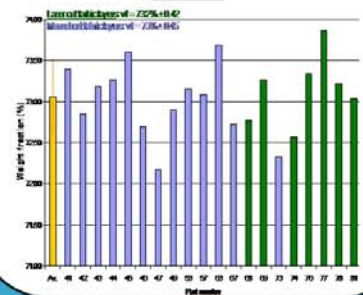
WEIGHT INFORMATION

- Resin injected before the 2nd injection
- Total of injected resin into the system
- injected resin
- fiber weight
- part part
- The weight of total weight (injected resin + fiber)



PART QUALITY (1/2) FIBER WEIGHT FRACTION

Mechanical Properties Related to:
 fiber weight fraction
 fiber volume fraction



EXPERIMENTAL SETUP

Edges: Net Shape Information
 - laser cut improves net shape

