HP-RTM and LCM Applications for Automotive Industry

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in cooperation with

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FPC @ Western

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Field of Technologies
Thermoplastic processing

- Injection Moulding (IM)
  - Injection moulding of long-fibre reinforced thermoplastics
  - Thermoplastic foam injection moulding (FIM)
  - Advanced processing technologies with CFR-TP
- LFT-D-ILC Compression Moulding (CM)
  - In-line compounding and direct processing of long-fibre reinforced thermoplastics in compression moulding
  - Tailored LFT-D
- Automated thermoplastic tape laying
  - Manufacturing of tailored CFR-TP structures
  - Functionalization of components
Field of Technologies
Thermoset processing

- **Direct Sheet Moulding Compound (D-SMC)**
  - Composites for Class-A applications
  - Direct processing of long-fibre reinforced thermosets in sheet moulding compounding

- **High Pressure Resin-Transfer-Moulding (HP-RTM)**
  - High performance composites
  - High pressure processing of thermosets in resin transfer moulding

- **Liquid Compression Moulding (LCM)**
  - High performance composites
  - Open mould application of resins and fabrics
Field of Expertise
Composite Characterization

- **Mechanical Testing**
  - Tensile, Flexural, 3 and 4 point bending testing at -129C to 482C
  - Impact testing (IZOD and Charpy)

- **Thermal Analysis**
  - Thermogravimetric Analysis (TGA LECO 701)
  - Differential scanning calorimetry (DSC Q2000)

- **Other**
  - Conditioning chamber for samples prior to testing (humidity and temperature)
  - Specimen cutting (water jet)
Injection Moulding
Thermoset & Thermoplastic

Technology

- Injection moulding of fiber reinforced phenolic thermoset resin for high temperature applications
- Advantages: long term durability, resistivity to solvents, high strength & modulus
- 550ton Arburg IM with thermoset & thermoplastic capability (MuCell option can be added)
- 1.35 x 1.35 m platen size (0.92 x 0.92 m tie bar clearance)
- Base/insert mould build with square insert 300x300mm
- Max insert size 0.8 x 0.9 m
HP-RTM vs. LCM

**HP-RTM**
- ~5 minute cycle time
- 3D geometry
- Thick parts

**LCM**
- ~3 minute cycle time
- 2.5D geometry
- Thickness up to 2.5 mm
Potential Applications

**HP-RTM**
- Leaf spring
- Roof frame

**LCM**
- B-pillar
- Tunnel reinforcement
When performed correctly LCM and HP-RTM result in same property composites
Equipment Requirement

- Lower mixing pressure
- Possibility to deposit resin at zero pressure
- Very simple equipment for “one component” systems
  - Phenolic
  - Vinyl ester
- Low press pressure

LCM requires much simpler equipment than HP-RTM
Reinforcement Material

- Carbon
- Glass
- Basalt
- Kevlar
- Fiber mats

- Possibility to modify the fabric to manufacture “smart composites”
  - Inherent de-icing properties
  - Sensors
Objectives

- Build a turn key LCM process in North America
- Develop a predictive model that would tie process parameters with molding results
- Geometry effect on parameters
Automated Liquid Compression Molding
Resin Deposition
Preforming

- Foaming
- Not resin penetration into the fabric
- Preforming pressure study
- Binder quantity study
Additional Geometry