

Indiana Clean Manufacturing Technology and Safe Materials Institute (CMTI)

Highlighting the Coating Applications Research
Laboratory's Successes in the Fiber Reinforced Plastics
Industry



*The World's Only Official Styrene
Emissions Test Lab
CMTI/CARL Purdue University*

CARL Milestones:

- Began specialized service to the FRP industry in 1999 and has become the industry's Emissions and Pollution Prevention Expert Center
- Generated New EPA Approved Emission Factors for New Non-atomized Gel-coat Application, now utilized Nationwide – 30% reduction in emissions
- Generated New EPA Approved Emission Factors for the New Generation Non-Atomized Resin Applicators, now utilized Nationwide – 30% reduction in emissions
- Proving ground for a new generation of emission reducing Ultra-violet light cured gel coats/resins – 60% reduction in emissions
- Proving ground for new generation of no-VOC/no-HAP containing resins 95 – 99% reduction in emissions
- Proving ground for new generation of no-VOC/no-HAP containing gel coats 94 – 99% reduction in emissions
- Proving ground for new generation of vapor suppressed resins – 18 to 25% reduction in emissions
- Proving ground for a new class of resin “fillers” (extenders) that reduce resin use and reduce emissions – 20 to 40% reductions in emissions
- Proving ground for new classes of low styrene resins and gel-coats – known as “hybrids” – reductions in emissions of 45 to 97%

World Class Companies have Contracted with CARL For Emission Test

- Ashland Chemical
- Pierce and Stevens
- Eastman Chemical
- Venus Gusmer
- Magnum Venus Products
- Valspar
- Cook Composites and Polymers
- Glas-Craft
- Fusion UV
- Novoc Polymers Company
- American Composites Manufacturers Association
- Others requesting confidentiality

Light-Resin Transfer Molding Project

From This:



To This:



L-RTM Partners

- **5 Separate leading FRP manufacturing companies in the Elkhart, IN area**
- **AOC**
- **Cook Composites and Polymers**
- **Dow Chemical**
- **American Electric Power**
- **American Composites Manufacturers Association**
- **Composites One**
- **RTM North**
- **Glas-Craft**
- **JHM Technologies**
- **Magnum Venus Products**
- **Ni SOURCE (NIPSCO)**
- **Cinergy**
- **Vectren**
- **Airtech International**
- **Freeman Wax Company**

Light-Resin Transfer Molding Project (L-RTM)

Continuing technical assistance to the State's \$6 billion industry

L-RTM Represents Emission Reduction Potentials of Greater than 85%

CARL lab will research and optimize an innovative alternative to the classic open mold method of FRP production – L-RTM. The project has generated approximately \$100,000 in cash and in-kind contributions and is completely funded by industry.

The project will investigate vacuum infusion of resin material into light mold tooling as an alternate method to open mold fabrication.

Master Mold for RV Rear Cap



Indiana Built Class A RV



Figure 8
No-VOC used on a tooling mold



Mold side of Female tool where sheet wax will be applied
This part is an interior cover over the motor of a class A motor home



Back of female tool mold
Adding reinforcement to give the mold strength



Application of sheet wax to make annular space thickness equal to the part for RTM resin to flow into.

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Foundation 2004



Application of filler material to fill gaps and smooth surface



Application of sheet wax and fine detail. Fine ridge is part of air vacuum channel.

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Application of all layers of sheet wax complete and red and black stripping to form seal channels in place.

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Placement of vacuum ports and resin injection ports.
The original female tool mold is under the sheet wax.

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Application of black tooling gel coat over several coats of PVA previously applied over the sheet wax surface. The PVA acts as a release agent to separate the wax from the gel coated tool contra-mold.

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Application of fine glass veil over the recently applied gel coat that was coated over the sheet wax underneath. Remember the original female-tool mold is under the gel coat and sheet wax.

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Complete build-up of over 7 layers of glass mat and tooling resin as well as balsa and steel reinforcement, all over the sheet wax which is still underneath.

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Newly constructed male tool mold (Contra-mold), turned upside down.

Female tool-mold



Original female mold now separated from the contra-mold that was constructed over top of it. Note that the sheet wax (95%) transferred to the contra-mold.

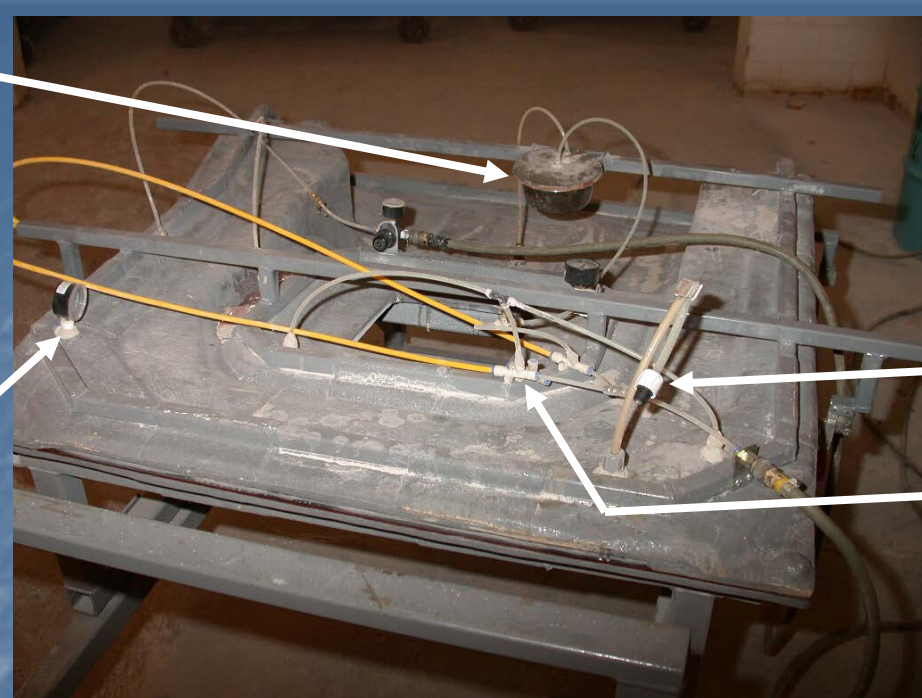


Remnants of sheet wax and PVA, yet to be completely removed.

This is the black gel coat which was the first mold layer applied over the wax. This contra-mold is now being clean and prepped. The sheet wax, as well as the PVA is removed from the mold's surface. The wax is discarded now that it has performed its job – allowing the exact sizing of the contra-mold.

Catch pot for resin overflow from cavity (cavity vacuum set at -15 in. Hg)

Flange vacuum (-25 in. Hg) Holds contra-mold to female mold



Contra-mold placed over the female mold and ready for resin injection

Resin injection tube

2 Venturi vacuums; 1 for vacuum flange and 1 for product cavity vacuum

Motor Cover produced via mold above



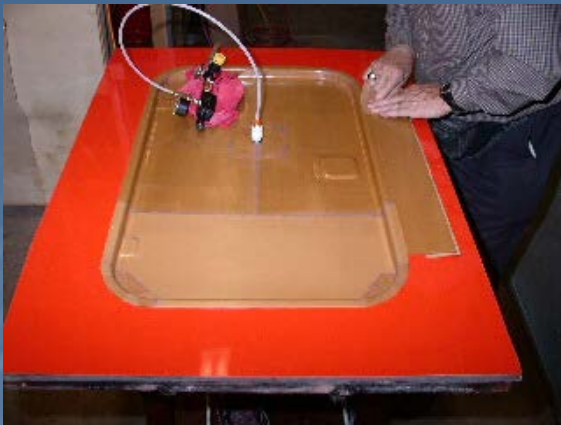
Smooth surfaces, top and bottom, without gel coat



Note: Smooth surface, no sharp glass shards or fibers, safer handling, consistent dimensions, accurate accounting of raw material usage, better component fit, etc..

Significantly stronger part than open-mold equivalent – tests to be conducted

27% lighter than open-mold equivalent.



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