Fiberglas Fabricators Upgrades Open Mold Processing Equipment

Minnesota Technical Assistance Program ■ CASE STUDY

Company	Fiberglas Fabricators Le Center, MN
Change	Nonatomized equipment replaced spray equipment in open mold process. Added raw material monitoring equipment.
Cost	$47,800 for new equipment. Payback is one to five years.
Benefits	Styrene emissions reduced by 50,400 pounds annually. Reduced 20,000 pounds of glass, resin and filler. Met requirements of the NESHAP. Cleaner production. Increased material efficiency.

Fiberglas Fabricators, in Le Center, Minnesota, makes fiber reinforced plastic (FRP) parts in a 40-person shop. The majority of parts are used by the electric utility industry as above ground electrical enclosures or access ways to underground enclosures. Parts are made using a variety of techniques including casting, closed molding and open molding. About 75 percent of all resin is consumed in the open mold process.

Using an open mold process to make FRP parts is waste intensive. Solid waste from overspray is high and styrene evaporation also can be high. In 2000, Fiberglas Fabricators used approximately four drums of resin and gelcoat to create parts each week, resulting in almost 80,000 pounds per year of styrene emissions from its open molding process.

Incentives for Change

The U.S. Environmental Protection Agency (EPA) classifies styrene as a hazardous air pollutant. The National Emission Standards for Hazardous Air Pollutants (NESHAP) for the reinforced plastic composites industry limited styrene emissions from FRP shops. Companies the size of Fiberglas Fabricators were required to use nonatomized application equipment for applying resin and glass. Fiberglas Fabricators needed to meet the NESHAP and its spray equipment was outdated, but money for capital expenditures was limited.

MPCA Small Business Environmental Improvement Loan Program

Fiberglas Fabricators secured a low-interest loan from the Minnesota Pollution Control Agency (MPCA) to purchase additional nonspray application equipment—four nonspray resin and glass chop guns—and four raw material monitoring systems to add production control in the open molding process. The company had already purchased a new gelcoater.

The MPCA's loan program provides low-interest loans to small businesses to help finance environmental projects such as capital equipment upgrades that help companies meet or exceed environmental regulations. Projects made possible through the loan program can benefit companies by reducing employee exposures, lowering waste disposal fees and reducing regulatory burdens. Businesses may also find that pollution prevention efforts qualify them for simpler environmental permits or licenses. Frequently, these benefits have a positive impact on the business bottom line. Find more information on the loan program at <www.pca.state.mn.us/programs/sbomb_loan.html>.

Process Change: Nonspray Application Equipment

Traditional application equipment requires high fluid pressure and/or air to properly mix the resin with the catalyst to form an appropriate spray pattern. These finely dispersed spray droplets have a large surface area, allowing styrene to evaporate. The finest droplets become overspray. Nonatomized application equipment mixes the resin and the catalyst together using an internal mix chamber, or external contact of the two streams. The mixture is applied as a continuous low pressure stream.

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With nonspray application, the surface area for evaporation is greatly reduced and finely dispersed droplets are negligible, resulting in decreased emissions. Internal mixing of the catalyst also reduces the amount of "free catalyst" entering the work environment, reducing flammability and health concerns.

Fiberglas Fabricators observed demonstrations of various nonatomized application equipment. The company chose the Magnum Venus Products (MVP) fluid impingement technology (FIT) system because it was economical and the most current technology. The noticeable reduction in styrene odor from resin and gelcoat application during the trial also helped drive the decision.

MVP FIT Gelcoater

An external mix MVP FIT gelcoat application system was selected. Implementing this system was straightforward and could be considered a drop-in substitute. With a minimal amount of operator training, Fiberglas Fabricators was able to produce high quality gelcoated molds using the same gelcoat. The quality of the finish met all expectations and requirements. The system's low operation pressure minimizes blow back of material—less material bounces back toward operators after hitting the part during application—as it is applied to the mold. Operators appreciated this benefit.

Not atomizing the gelcoat reduced overspray, giving Fiberglas Fabricators significant material savings. The company estimated a five percent reduction in gelcoat purchases. Emission factors supplied by the American Composites Manufactures Association Unified Emissions Factor (UEF) Model suggest a 35 percent reduction in styrene emissions due to the gelcoater, using the same gelcoat and nonatomized spray application. Styrene emissions from the gelcoat operation may drop by nearly 3,400 pounds per year.

MVP FIT Chopguns

The company purchased four internal mix MVP FIT units for the chopping stations. The greatest issue was that wet-out appeared inadequate. With nonatomized application equipment the resin has less opportunity to coat the glass as the mixture is added to the mold. As the part sits, the resin coats the glass. But, because the glass appeared to be under-saturated with resin, the operators' initial tendency was to apply more resin. This can lead to excessive material use and may create heavy parts. After training operators and a short learning period, part weights were more on target and consistent. The operators found that the glass distributed uniformly in the liquid fan pattern and produced an even composition of resin and glass on the mold. This helps the operator apply an even mil thickness and minimizes the amount of roll out needed.

Fiberglas Fabricators uses a filled resin system and suspected that the filler components might clog the relatively small holes of the new chopguns' nozzles. But, this did not happen. Parts on the FIT system were easier to handle than on the old system, making equipment cleaning easier. In addition, the application became cleaner and less solvent was used for general external cleanup. This offsets the additional solvent required to flush the internal mix chamber after use. Less overspray was produced, resulting in less material used. Because the system operates at lower pressures than traditional equipment, less compressed air was needed.

Considering the same resin for the spray and nonatomized case, the UEF model predicts nearly a 65 percent decrease in styrene emissions due to the nonatomized chopguns. The company expected to reduce styrene emissions by an estimated 46,000 pounds per year using the chopguns.

Production Control: Real-time Monitoring of Materials Use During Chopping

A raw material monitor helps control the FRP manufacturing process and improve quality. The device gives the operator real-time knowledge of the amount of glass and resin applied to a given mold. The simplest monitors display the amount of resin and glass applied, total materials applied and percent glass in the laminate. More sophisticated monitors automatically log the booth information on a part-by-part basis, creating a production record that shows the true cost of materials for each part. Fiberglas Fabricators purchased four Technology for Manufacturers (TFM) raw material monitoring devices.

Without real-time information, operators tend to produce a larger number of parts that are either too heavy or too light. Each part generally has a minimum specified weight. All parts leave the plant at the target weight or higher. Parts that are too light have to be reprocessed to obtain the target weight. This increases labor costs and reduces the production efficiency of the entire operation. While parts that are too heavy rarely need rework they are a significant

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revenue loss because of excess material use and increased shipping costs. Part-to-part consistency and quality is increased when part weights are on target and uniform. Monitors also can function as an effective training tool. Fiberglas Fabricators found that the monitors helped new employees become efficient and effective in their jobs at a much faster rate.

Fiberglas Fabricators did not have detailed data to calculate specific savings from the TFM systems. But, some generalizations could be made. The company's average weight of finished parts was closer to the target weight. Although rework of light parts was not eliminated, the frequency was reduced. The following conservative calculations reflect Fiberglas Fabricators' savings as a result of reducing the average weight of finished parts.

Since the monitors were installed, the average part weight overage dropped from five percent to three percent. Using 2000 production data, this reduction equals nearly 20,000 pounds of glass, resin and filler combined. At around $0.50 per pound of material passing through the chop guns, Fiberglas Fabricators saves $10,000 per year. In addition, the decreased use of resin cut styrene emissions by another 1,000 pounds per year.

Cost and Benefits

- Total capital expense of $47,800. $4,500 for one external mix nonatomized FIT gelcoater, $16,300 for four nonatomized FIT chop guns and $27,000 for four TFM material monitoring devices.
- Savings in materials include $3,000 per year in gelcoat as a result of reduced overspray and $10,000 per year as a result of a narrower range for overweight parts. Toxic Release Inventory and air permit related fees will decrease by $1,700 per year because of reducing styrene emissions by 50,400 pounds.
- Reduced volatiles in the resin or gelcoat and fewer emissions released during application and curing result in more product produced per gallon or pound of resin or gelcoat consumed. Based on the amount of resin or gelcoat consumed, lower styrene emissions can improve product yield by five to 10 percent. Fiberglas Fabricators estimates savings of $5,000 per year in gelcoat purchases and $17,000 per year in resin purchases. Glass/filler to resin ratios need to be re-calibrated to realize these savings.
- Payback period of one to five years, including the loan interest.
- Real-time monitoring of part processing improved quality and part-to-part consistency and gave operators a tool to help continually improve their technique.
- Nonatomized application equipment is compliant with the EPA's Reinforced Plastics Composites NESHAP.
- Reduced styrene emissions and less overspray resulted in a cleaner work environment, which was a welcome relief to employees.
- The paperwork and approval process for obtaining the MPCA Small Business Environmental Improvement Loan represented no major barriers. The low-interest rate was a strong economic incentive to the business.

For More Information

Other MnTAP publications for the FRP industry:

- Controlled Spraying and Laser Touch in the Fiber Reinforced Plastics Industry [#89]
- Fiber Reinforced Plastic Shop Complies with New Air Permit Regulations [#83]
- Fiber Reinforced Plastics Shop Implements Light RTM to Produce Parts [#41]
- Reducing Volatile Emissions in the Fiber Reinforced Plastics Industry [#75]

MnTAP has a variety of technical assistance services available to help Minnesota Businesses implement industry-tailored solutions that prevent pollution at the source, maximize efficient use of resources, and reduce energy use and cost. Our information resources are available online at <www.mntap.umn.edu>. Or, call MnTAP at 612/624-1300 or 800/247-0015 from greater Minnesota for personal assistance.