Recycling and Reuse Technology Transfer Center

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FIBERGLASS WASTE

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exothermic reaction went forward decreasing the drying time. Stimulating the reaction like this is not desired due to the loss of control and does not allow for adequate spraying time. So, Deflecta-Shield did not consider recycling as an option for their fiberglass process. Through further discussion however, some real advantages to being able to put the waste fiberglass back into the process were established. The most important advantage is that the heat from the exothermic reaction would be absorbed. This helps avoid excessive shrinkage and distortion of the final products. Using the reclaimed material as a filler decreases the quantity of the virgin polyester resin used in the process. One last advantage is that the waste fiberglass would increase the structural integrity of the product.

The characteristics of the chemicals involved in the fiberglass production were established through a discussion with the Center for Industrial Research at Iowa State and Winnebago Industries in Hampton, Iowa. It was determined that the fiberglass resin was an irreversible thermoset polyester with a double bond which was referred to as a vinyl group that can be crosslinked with a free radical catalyst. A number of peroxide curing agents are available for initiating polyester resins. For this process, methyl ethyl ketone (MEK) peroxide is a free radical catalyst commonly used for room temperature curing or hardening of the resin. This raised the question as to what effect would temperature have on the curing process of the fiberglass resin? The most important question is can or will the catalyst (MEK) peroxide still be present in the fiberglass waste and is this the reason for the early initiation of the reaction in the thermoset polyester process? Finally, if the catalyst (MEK) is present in the fiberglass waste, can the resin or the (MEK) peroxide be inhibited? Simply, can the reaction be stopped, thus keeping the resin in liquid form for a

The third experiment was when the fresh simulated fiberglass made in the lab was exposed to air for a seven day period. The procedure was repeated with only the virgin polyester resin. The resin and 30% of the air exposed fiberglass particles when mixed this time showed no hardening. After ten days, the mixture was still in a thick liquid form. This ten day old mixture was placed in a 1000 ml beaker and 5 ml of (MEK) peroxide was added. The resin and the fiberglass waste particles hardened in 24 hours like the simulated fiberglass in the first experiment. The final experiment was performed by introducing an anti-oxidant called hydroquinone to the simulated fiberglass process. As before the polyester resin and 5 ml of (MEK) peroxide were mixed in a beaker (4A). One-half of the mixture was placed in a separate beaker (4B) and 2% of hydroquinone was added. Beaker (4A)hardened within 24 hours while beaker (4B) did not hardened after seven day time period. In fact after 21 days the mixture is still in liquid form.

DISCUSSION:

The actual simulation of the fiberglass process first included researching the chemicals and the quantities used to duplicate the process. Deflecta-Shield provided the information of a two percent ratio of (MEK) peroxide to the polyester resin used in their specific fiberglass production. They also suggested that the purchasing of the chemicals should be through their supplier which is GLS Corporation out of Des Moines, Iowa. Upon contacting GLS Corporation, it was determined that the smallest quantity that could be purchased was a 55 gallon drum of the polyester resin along with one gallon of the (MEK) peroxide. This would be too much for a practical laboratory replication of the process. But, GLS Corporation recommended going to the local NAPA Automotive Center where they sell the exact chemicals in quantities of one gallon of resin along with data sheets on (MEK) peroxide offered no support to evaporation as the physical data on the evaporation rate was not listed. Determination of the evaporation rate could lead to a series of research and laboratory experiments if desired by the industry.

To expand upon the idea that the (MEK) peroxide was removed after a time period, the freshly simulated fiberglass waste particles were exposed to air for seven days. Repeating the procedure exactly like experiment one, but now using the air exposed particles showed that the reaction did not take place. After ten days had passed, and the mixture was still in liquid form, the (MEK) peroxide was added in, resulting in the hardening of the fiberglass within 24 hours. Looking at the results of the experiment leads to some interesting hypothesis. The most important suggestion would be to repeat this experiment in a large scale three-way spraying application process identical to Deflecta-Shield. This would eliminate any discrepancy between the laboratory atmosphere and the factory setting. Factors to consider are to make sure that the particles generated from the fiberglass waste are small enough to move through the process without inhabitation such as the clogging of the spraying apparatuses. The other is to ensure that the fiberglass waste particles have enough exposure time to air so the (MEK) peroxide is removed and does not cause the virgin resin to harden prematurely.

Elaborating on the presence of the (MEK) peroxide catalyst, in all the experiments the concentration of the catalyst was controlled to a two percent ratio in the lab. So it should be recommended that a flow device be used to monitor the amount of the catalyst being used in Deflecta-Shield's fiberglass production. If the (MEK) peroxide is greater than two percent, this would increase the chances of it being present in the fiberglass waste even after exposure to the atmosphere. The bottom line of this experiment is that the waste particles alone did not allow the reaction take place. But , as in the simulation of the fiberglass process, the addition of the (MEK) peroxide catalyst did make the reaction go forward hardening the polyester resin. This concludes that there is a good possibility that the fiberglass waste could be recycled within the process.

The final experiment was to inhibit the polyester reaction completely. An anti-oxidant such as hydroquinone is commonly used to inhibit free-radical chemicals which is the catalyst in this process. The results show that the reaction would not take place in the presence of hydroquinone. Due to the lack of time, further testing of the effects of the anti-oxidant on the reaction was not possible. Once again, this presents the need for more testing to determine the possibilities of controlling the addition of the fiberglass waste to the thermoset polyester crosslinking process.

RECOMMENDATIONS:

The first recommendation would be to carefully monitor the amount of (MEK) peroxide used in the fiberglass process. This could be accomplished using a flow meter that could register and record the quantity of (MEK) peroxide that is being sprayed during the application to the castings. It is critical to use the smallest amount of (MEK) peroxide as possible. Grinding the fiberglass waste into small particles will help in the removal of any (MEK) peroxide that could be left on the reclaimed material. This would increase the surface area of the waste and allow for increased aeration. The last recommendation is that the industry try these suggestions in their own process. Performing bench scale experiments does not provide the factory atmosphere needed to truly test these recommendations. Contacts are listed on the following page.