

# **RECOVERY OF WASTE PVC COATED PET FABRICS BY SWELLING METHOD**

## **FINAL REPORT**

By

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This work focused on investigating a novel recycling technique, swelling method, to recovering PVC coated PET fabrics. This technique used a chemical as a swelling agent to swell the only PVC component in the coated fabric. This process degrades the mechanical properties of PVC component which allows it to be broken into small pieces and detached from the PET fabric substrate by mechanical agitation. The recovered products, PVC particles and PET fabric or yarn agglomeration, were obtained by screening.

The choice of swelling agent is very important in this method since it influences the processibility and cost of the recycling procedure. By comparing the physical and chemical parameters of some candidates, methyl ethyl ketone (MEK) was selected as a swelling agent, mixed with water in different amounts to form a swelling bath.

In the swelling system, the phase property of MEK/water influenced the solubility parameters of swelling bath, which changed swelling behavior of PVC component in coated fabrics and finally affected the recycling process.

However, recovered PVC component lost more than half equivalent of the plasticizer. The other recovered components were very similar to those in virgin PVC component in coated fabric, so that it could be reused as coatings in the manufacture of PVC coated fabrics. Recovered PET fabric scraps had glue and kept their properties unchanged. For the purpose of added value recycling, they were further treated with dimethyl formamide (DMF) to remove the glue and yield pure PET fibers.

If other conditions are constant, temperature influences glue-removing process and final PET fiber properties. The orientation of both molecular chains and segments in treated PET fiber decreased with DMF bath temperature, reducing the tensile strength and sonic modulus of PET fibers but increasing the elongation. The experimental results showed that average size of crystalline region was a function of temperature.

The research work also covered applications of recycled substances. Recycled PET fabric scraps with glue was used as substrate to reinforce epoxy composites. Glue-free PET staple fibers were used to make needle-punched nonwoven fabrics.

This research completed the first part of work in the development of swelling method to recycle of PVC coated PET fabrics. It made a theoretical investigation and yielded some fundamental data for future development. There are still problems to solve, such as separation of PVC and polyester fiber, recovery of washing wastewater and DMF/glue mixtures, designing of corresponding equipment and pilot tests.

### Refereed Articles Published:

- Adanur, S., Hou, Z., and Broughton, R. M., "Recovery and Reuse of Waste PVC Coated Fabrics, Part 2: Analysis of the Components Separated from PVC Coated PET Fabrics", Journal of Coated Fabrics, Vol. 28, October 1998.
- Adanur, S., Hou, Z., and Broughton, R. M., "Recovery and Reuse of Waste PVC Coated Fabrics, Part 1: Experimental Procedures and Separation of Fabric Components", Journal of Coated Fabrics, Vol. 28, July 1998.

### Presentations with Conference Proceedings:

- Hou, Z., and Adanur, S., "Direct Use of Waste PVC Coated Fabrics to Reinforce Composites", Proceedings of the 1999 International Mechanical Engineering Congress & Exposition, 99-IMECE/TEX-5, November 14-19, 1999, Nashville, Tennessee.
- Adanur, S. (50%), Hou, Z. \* (50%), "Recycling and Reuse of PVC Coated Polyester Fabric", TCL7, Proceedings of the 7th International Conference on Textile Coating and Laminating, Charlotte, NC, November 1997.

### Thesis

- Hou, Z., Master of Science Thesis, Auburn University, December 1997 (directed by Dr. Adanur)

### Industry Interaction:

- Bo-Tex Sales Corporation
- Cooley, Inc.
- C. M. Offray & Son, Inc.
- John Boyle & Co., Inc.
- Weblon, Inc.
- Bruin Plastics Co.

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