SUMMARY REPORT
PVC Coated Fabric Trim Waste Recycling

1. Introduction

Athol Corporation has been making polyvinyl chloride (PVC) coated fabric in Granville County for over 40 years. The vinyl we make is used primarily in seating and interiors for school buses and cars, but also in mass transit, the marine industry, and other applications. Athol Corporation manufactures the vinyl in rolls of fixed widths. The edges of the vinyl are trimmed to provide the specified width. The resulting trim is a non-uniform film of vinyl laminated to cloth. The trim material is composed of "flexible plastic", or PVC, and the cloth backing or substrate. The cloth is typically polyester woven or non-woven material.

The subject trim has been landfilled as a waste stream. The volume of landfilled trim is approximately 500 tons per year. Athol Corporation has been seeking alternatives to landfilling the material and in 1995 applied for a Challenge Grant from the State of North Carolina’s Office of Waste Reduction. The Grant was awarded and primarily directed toward the pursuit of cryogenically freezing and grinding the trim in order to recycle the PVC.

2. The “Mr. Freeze” Approach

PVC film can be recycled and Athol Corporation routinely adds ground up scrap PVC to make product. The difficulty lies in the addition of the cloth, which prevents Athol from recycling the trim. Research indicated that some industrial applications were successful in cryogenically freezing materials to make them brittle and subsequently allowing the materials to be ground and pulverized. Athol worked with a potential vendor, Whitlock Industrial Equipment of Matthews, NC, to explore this option. After broad discussions, it was determined that a trial using a pilot scale grinder would be in order.

Athol sent a batch of trim to Micron Powder Systems in Summit, NJ for them to chop the trim into pieces small enough to process cryogenically. The resulting chopped trim was forwarded to the pilot scale liquid nitrogen grinding system at Air Products in Allentown, PA. On October 5, 1995, Jim Hayes, Tom Baucom, and Nathan Cobb of Athol Corporation traveled to Allentown to oversee the pilot test.

The first problem noted was that when Micron chopped the trim, the cloth backing fluffed up into a large volume that made handling difficult. However, it was not too difficult to separate the PVC bits from the significantly larger portion of polyester fluff. The PVC bits retained some cloth backing.
At Air Products, the polyester fluff was set aside and the PVC bits were used to feed the pilot scale freeze-grinder. A drawing of the equipment is included in the attachments to this document. The bits were subjected to liquid nitrogen at -320°F and then processed through the hammer mill and the 20 micron screen. A fine PVC powder resulted initially, but the hammer mill soon jammed. The screen was causing the generation of heat that resulted in the formation of large chunks of PVC which jammed the hammer mill. After the unit was brought to room temperature and cleaned, a second attempt was made with a larger mesh screen.

More bits of PVC were added and cooled to -320°F and ground in the hammer mill through a 46 micron mesh. This resulted in an entirely satisfactory PVC grind, but in short order the mill jammed again. The polyester backing did not become brittle enough and would not go through the screen. This resulted in a build-up of fluff in the hammer mill that ultimately jammed the mechanism.

Athol discussed the trial in depth with the operators of the pilot unit at Air Products. They indicated that they had tried the unit on other applications that involved cloth laminates and had the same problem. While the PVC becomes brittle enough to grind into a very useful powder, the cloth that is an integral part of the trim would always jam the grinder. We concluded that their configuration had limitations that made its use for our trim application infeasible. We also concluded that the grinding problem that Micron Powder Systems ran into while chopping the trim prior to freeze-grinding would result in enormous handling problems on site with the volume of fluff produced.

Jim Hayes of Athol contacted Rouse Rubber Company of Vicksburg, MS. Rouse has been using the cryogenic process to shred tires. Discussions progressed over several months, but Rouse wanted an entire unit dedicated to trim scrap only, even for trials. Due to the fact the Rouse did not feel Athol alone would generate sufficient scrap to economically justify a project, this option never developed and our contact there retired.

3. The “Slow Boat to China” Approach

In 1996 Athol consulted recycling companies about possible programs. Athol received a proposal from Orange Recycling Services of Durham, NC, to send trial samples to China. A firm in China was interested in removing the cloth from the PVC in order to have an inexpensive source of PVC. The initial sample was approved, so Athol Corporation began saving all of the trim scrap generated from the Extrusion process and baling the trim into two ton bales.

Athol had an existing scrap baler in a neighboring facility, so all of the trim was transported across the street. As the bales of trim scrap accumulated, they were loaded onto a tractor-trailer. Athol baled this trim scrap from February 1996 through May 1996. On May 13th the truck was full and sent through Norfolk, VA to China. Approximately two months later Orange Recycling called and informed Athol that the removal of the cloth proved too difficult and that the receiver had decided not to pursue this option further.
4. The "We'll Try Anything Once" Approach

In the Spring of 1996, Athol hosted a meeting with Joseph Davis, who represented the Industrial Extension Service of North Carolina State University and their Manufacturing Extension Partnership. Mr. Davis had a lot of experience in waste minimization and we discussed the trim scrap problem. One of the areas we explored with Mr. Davis was minimizing the width of the material to reduce the amount of excess that had to be trimmed. We also contacted Mr. Peter Schoots of the North Carolina State University regarding expertise in the Nonwovens Cooperative Research Center.

Polymer Reclalm and Exchange of Mebane, NC sent a representative to Athol at our request to collect samples of the trim and try to find a market for it. The samples did not find any interested parties.

From a January 6, 1997 article in "Plastics News", I contacted Merritt-Davis of Hamden, CT. The article implied they had developed a mechanical solution to recycling trim. In the discussion with them they clarified that they did not have any solutions for PVC once substrate had been applied, such as our trim. They were familiar with cryogenic approaches and other attempts, but were not aware of any successful recovery program for trim.

5. Summary

The disposition of scrap plastic or PVC with substrate attached is an industry-wide problem. I questioned the members of the Environmental Committee of the Chemical Films and Fabrics Association (CFFA) and they reported having the same problem with trim disposal. Athol attempted the cryogenic approach and met with both success and failure. It was demonstrated that the PVC can be frozen and ground to a reusable powder. However, the technical difficulties presented by the polyester fluffing made the configuration attempted infeasible. Additionally, removing the substrate from the PVC proved too challenging to be used as a means of recovery, even in the overseas market.

Athol recommends that the industry trade groups work together to see if the combined scrap from several vinyl industries could provide incentive for a recovery company to pilot a recovery technology program. This may be possible through the CFFA or the Vinyl Institute. Additionally, it may be possible to enter a cooperative program with an engineering school, such as North Carolina State University, to seek alternative solutions.
POINTS OF CONTACT

Tom Harkness
WHITLOCK INDUSTRIAL EQUIPMENT, INC.
P.O. Box 1640
Matthews, NC 28106
(704) 841-8553

Andy Ondush, Scott Schraden
AIR PRODUCTS
Allentown, PA
(610) 481-4911 Ext. 5965

Michael Bohon
MICRON POWDER SYSTEMS
10 Chatham Road
Summit, NJ 07901
(908) 273-6360

Rich Taylor
PULLMAN PULVERIZERS
820 Bloomfield Avenue
Clifton, NJ 07012
(201) 471-1450

Jessie Oldham
ROUSE RUBBER CO.
1000 Rubber Way
Vicksburg, MS 39182-0369
(800) 487-6873

Perry Black
ORANGE RECYCLING SERVICES
904 East Ramseur Street
Durham, NC 27701
(919) 688-5660

Joe Altimari
MERRITT-DAVIS
Hamden, CT
(203) 230-8100

Joseph Davis
Industrial Extension Service
NORTH CAROLINA STATE UNIVERSITY
Box 7513
Raleigh, NC 27695-7513
(919) 515-8584

Athol Corporation
100 22nd Street, P.O. Box 105, • Butner, North Carolina 27509 • 919-575-5623 • FAX 919-575-9344
Warehouse • 528 Townsend Ave. • PO Box 7588 • High Point, NC 27264 • 910-434-4113 • National WATS 800-334-7724
Automotive Sales • 2525 Telegraph Rd. Suite 104 • Bloomfield Hills, Mi. 48302 • 810-332-1144 • FAX 810-332-2959