

Materials Recovery From Shredder Residues

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Argonne National Laboratory

- Facilities owned by U.S. Government
- Operated by the University of Chicago
- Contract R&D
 - 80% DOE
 - 20% Other govt. agencies and industry

Argonne National Laboratory

- 4,500 employees, 1,800 Scientists and Engineers
- Scope of Projects
 - Basic sciences
 - Energy sources and supply
 - Energy conservation
 - Industrial energy and environmental technology

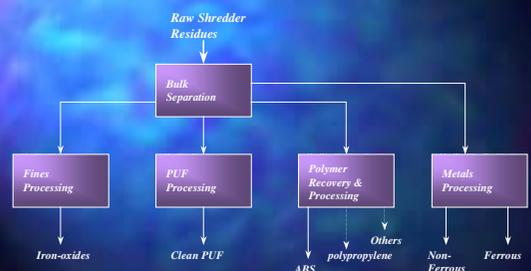
Shredder Residue Separation Technology History

- Research Started in 1987
- Focused on Materials Recovery Rather than Bulk Uses (e.g. Landfill Cover, Pyrolysis)
- Collaborators included
 - Vehicle recycling partnership (ford, GM, Chrysler)
 - Scrap processors and recyclers
 - American plastics council

Status of the Argonne Technology

- Separation Process Feasibility Confirmed in Large Pilot-Scale Tests
- Process Economics Favor Separation vs Dismantling (e.g. Foam Recovery Costs Less than \$0.50/kg vs \$1.00 to \$2.00/kg for Foam Recovered by Dismantling)
- Process Licensed to Salyp N.V.

Process Modules



Technology Development Issues

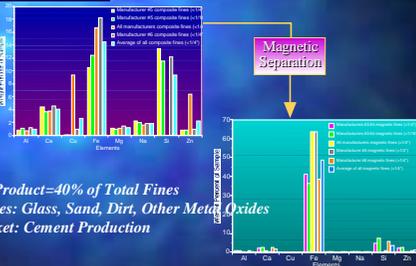
- Confirmation of Markets for Recovered Materials/Products
- Optimization of Polymer Recovery & Processing Module
- Scale-Up of Process Module Equipment
- Decontamination of Residual Material

Bulk Separation



- Pilot-Scale Capacity = 2 mt/h
- Full-Scale = 10 mt/h
- 1 mt of Shredder Residue Yields
 - 75 kg dirty foam
 - 400 kg fines; -6mm
 - 400 kg plastics concentrate
 - 125 kg metals

Magnetic Separation of Fines Yields Iron-oxide Product



- Iron-oxide Product=40% of Total Fines
- Residual fines: Glass, Sand, Dirt, Other Metal Oxides
- Target Market: Cement Production

Foam Recovery and Cleaning



Pilot-scale Foam Cleaning and Recovery Equipment



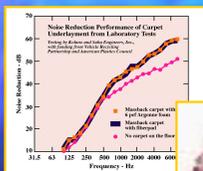
- Residence Time= 5 min
- Pilot Design Capacity= 50kg/h
- Full-Scale Design Capacity= 250kg/h

Foam Rebonding



- Major Markets Include:
- Automotive Carpet Pad
 - Automotive Sound Suppression
 - Residential/Commercial Carpet Pad
 - Export

Acoustical Tests Confirm Product Acceptability for Automotive Use



Polymer Recovery and Processing

- Basic Process is "Froth Flotation"
- Process Confirmed in Large-Scale Demonstration for Recovery of ABS from ABS/HIPS Mixture
- Bench-Scale Research Confirms Process for Polymer Recovery from Shredder Residue (ABS, Polypropylene, PVC, EPDM)

Froth Flotation Plastics Separation Equipment



Design Capacity= 450kg/h

Injection-Molded Parts From 100% Post-consumer ABS



Conclusions

- Key process technologies for recovering recyclable materials from shredder residues have been developed.
- Scale-up is required to confirm process equipment design and performance.
- Market/product development is essential for commercial success.
- Process optimization is required to maximize materials yield.
- Process residuals can be readily treated (if required) to ensure compliance with future ELV related directives.

And

- Argonne will continue to work with Salyp to improve the effectiveness of our technology and to support "the Salyp approach to ELV recycling."