Argonne National Laboratory's Froth Flotation Process for Recovering Usable Plastics from Mixed Plastics Waste

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Industrial Collaboration

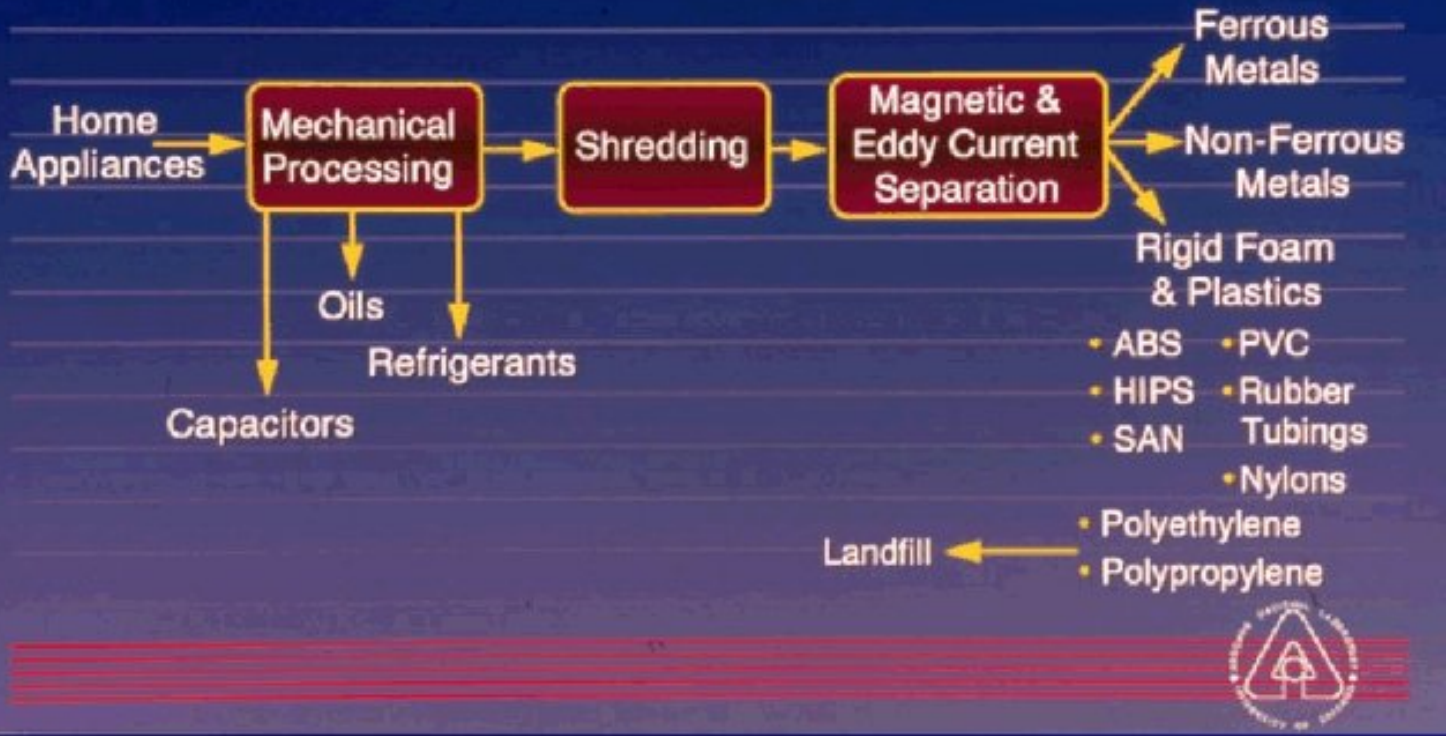
- Appliance Recycling Centers of America, Inc.
- General Electric Co., Specialty Chemicals Group
- Bayer Co., Polymers Division
- QTR, Inc.
- University of Akron, Polymers Engineering Dept.

Project Objectives

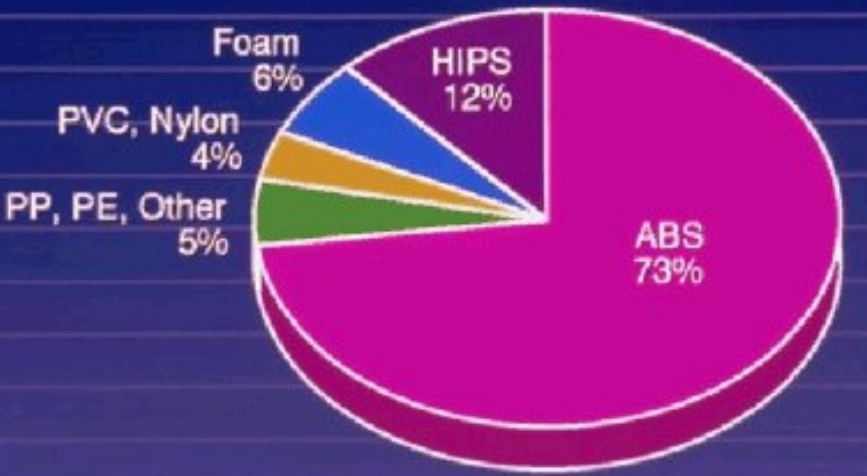
Collaborate with the industry to:

- Develop cost-effective technologies/processes for recovering and reclaiming high purity plastics materials from obsolete appliances;
- Identify high-value applications for recovered plastic materials

Recycling of Home Appliances
Present Practice

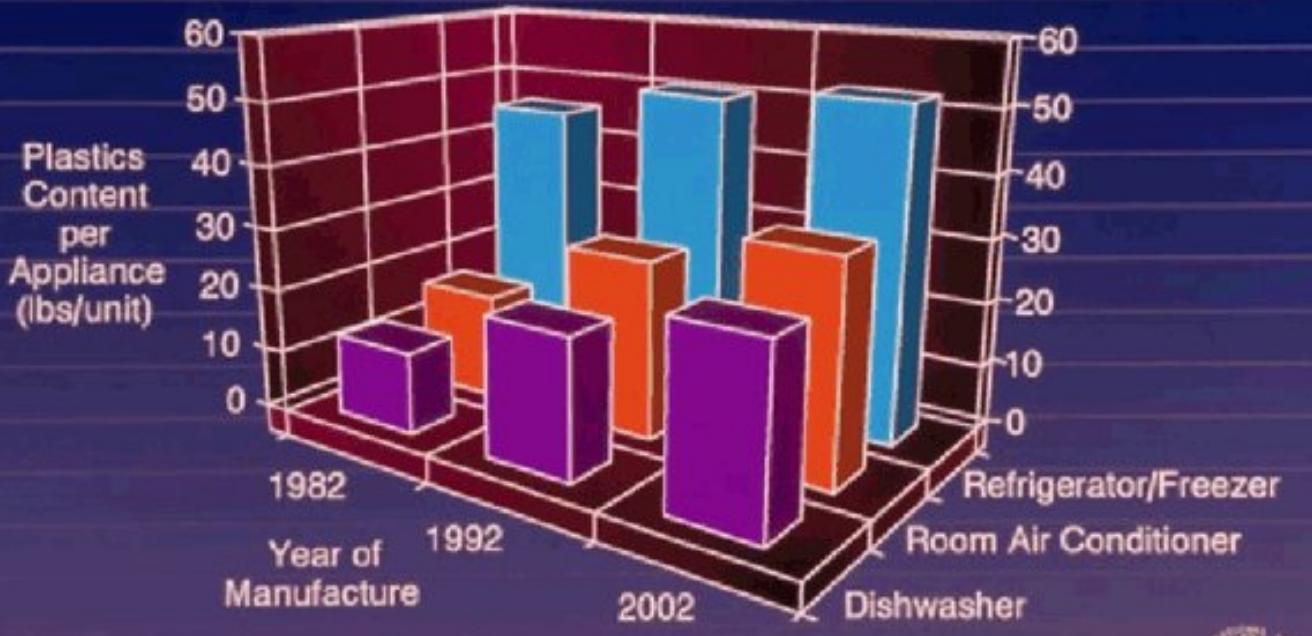


Composition of Appliance Fluff*

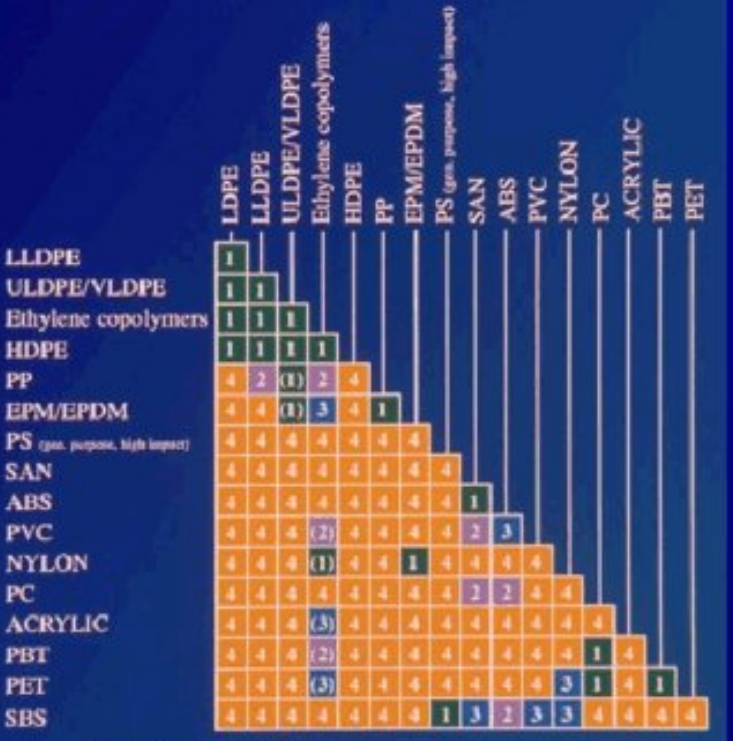


*ANL - Typical refrigerator fluff

Estimated Plastics Content in Some Typical Appliances (lbs/unit)



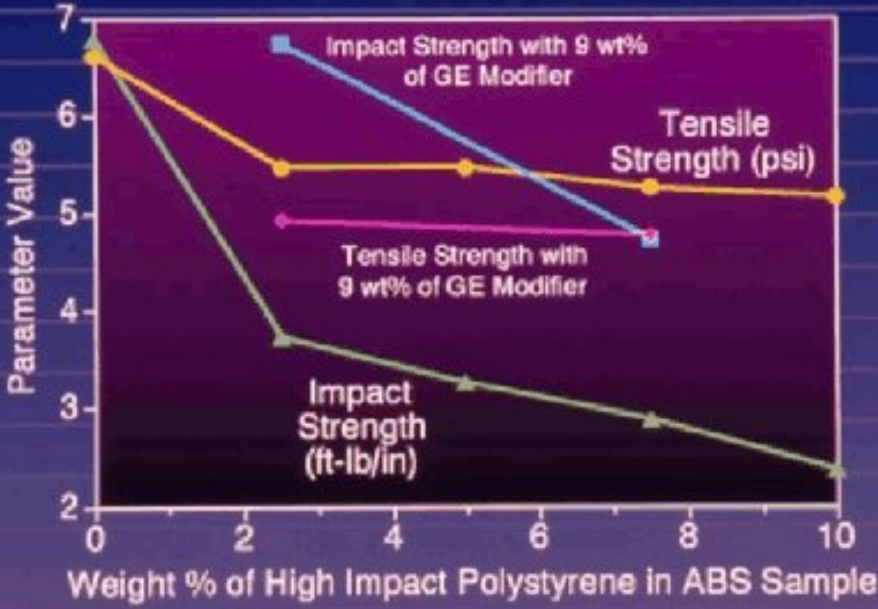
Compatibility of Polymers



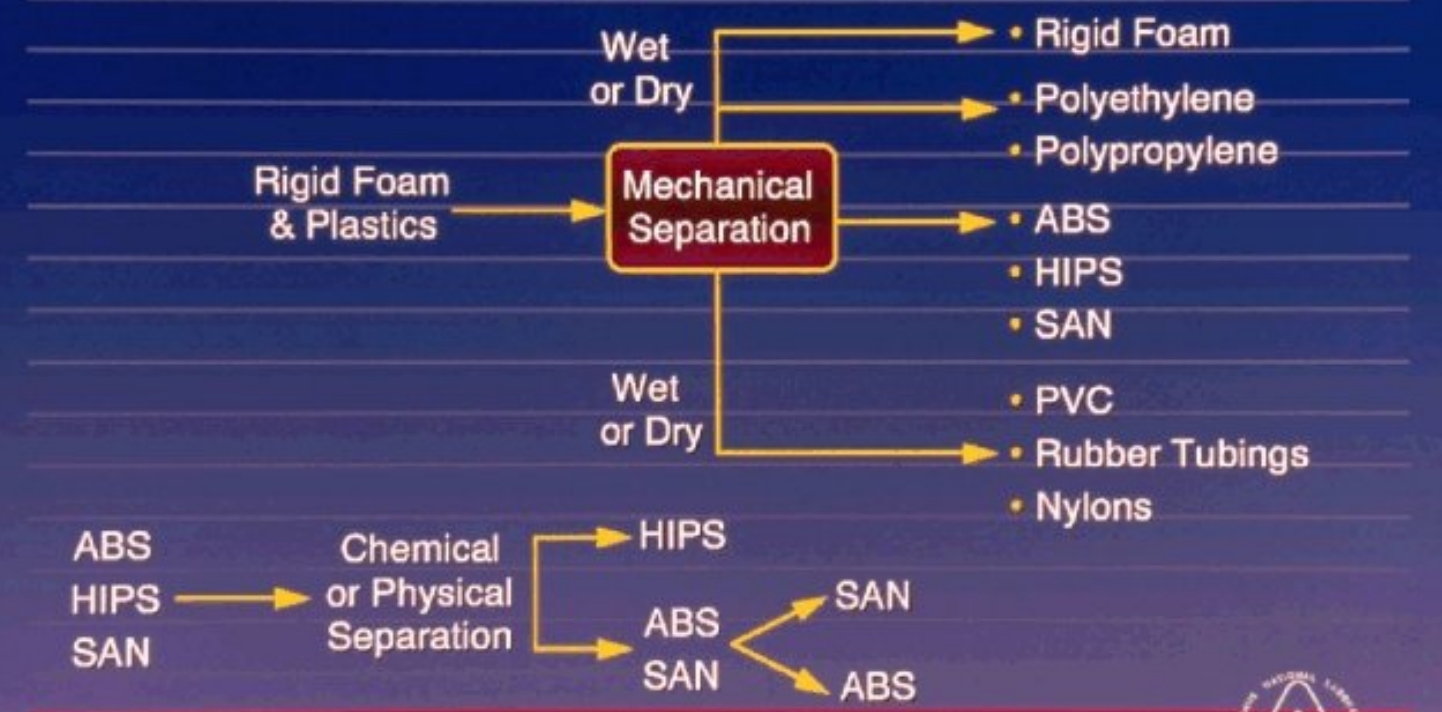
1 = excellent
2 = good
3 = fair
4 = without compatibility
(1) (2) (3) = compatibility depending on composition

Source: S. Fuzessery, Mauck Business Services

Impact of HIPS Contamination on ABS Properties



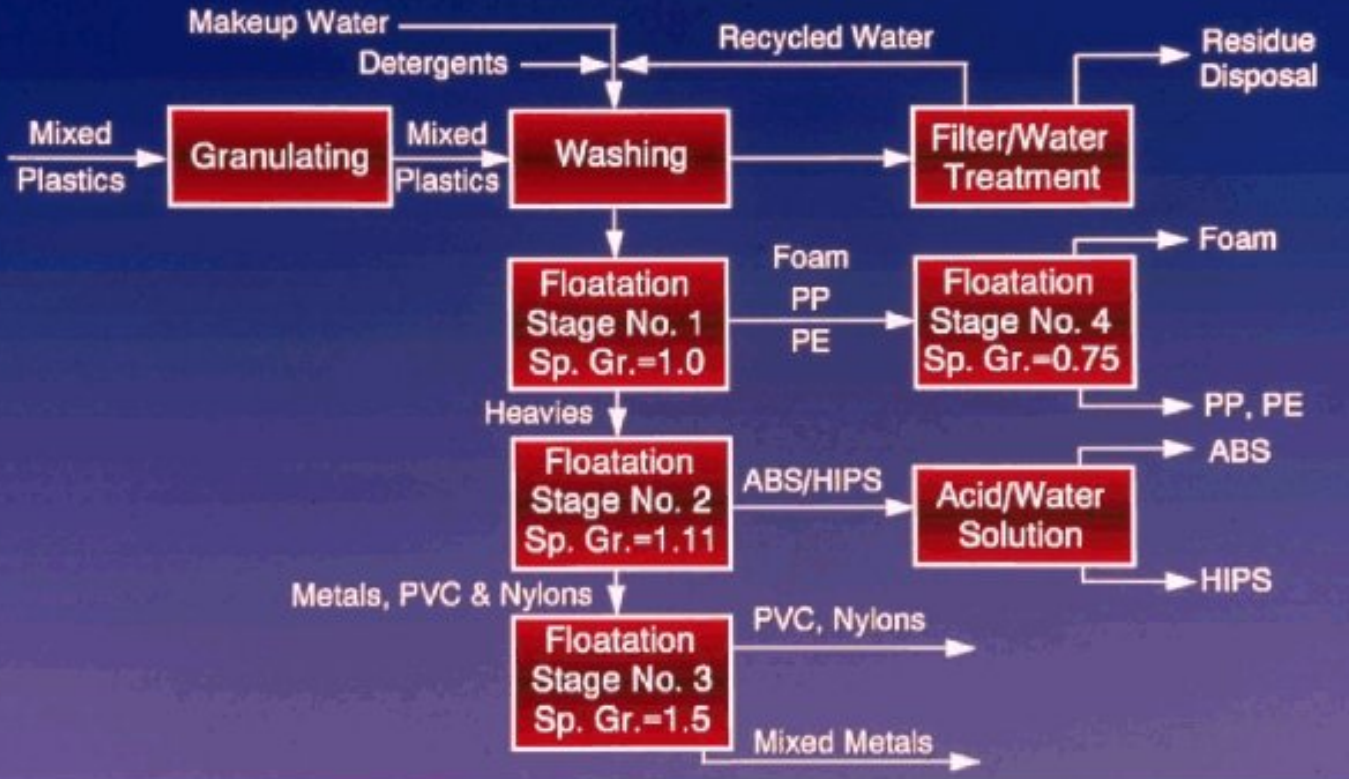
The ANL Plastics Separation Process



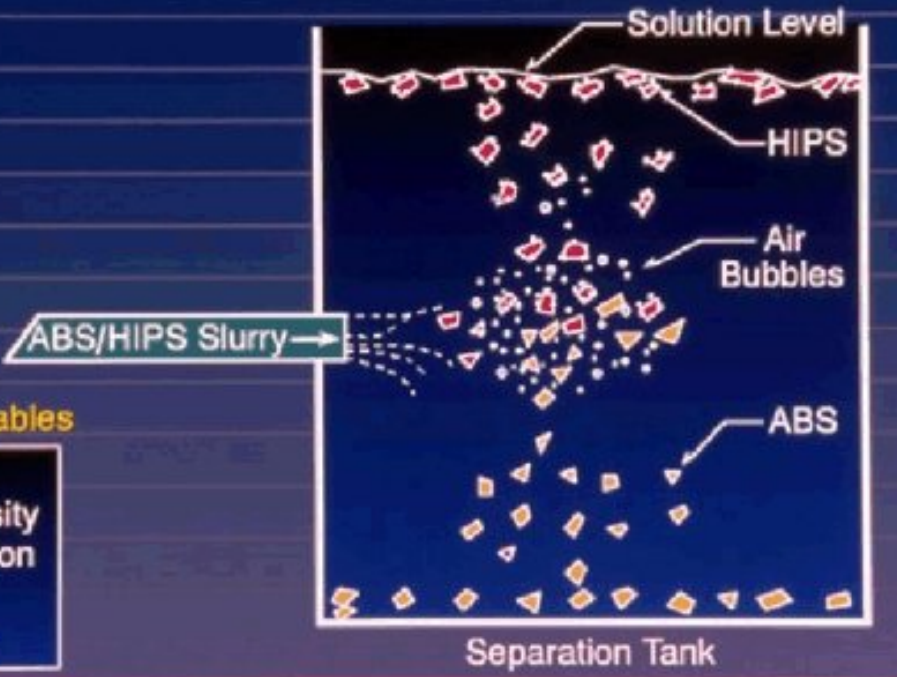
Density Separation Techniques are Partially Effective for Recovering High-Value Plastics from Appliance Fluff

Plastics	Density (g/cm^3)
PU	0.70
PE	0.90
PP	0.90
ABS	1.04-1.13
HIP	1.02-1.09
PVC	>1.15
Nylon	>1.12

Argonne Process for Separating Plastics from Appliance Fluff



Froth Flotation System for Separating Equivalent Density Materials: Separation of ABS from HIPS



Controlled Variables

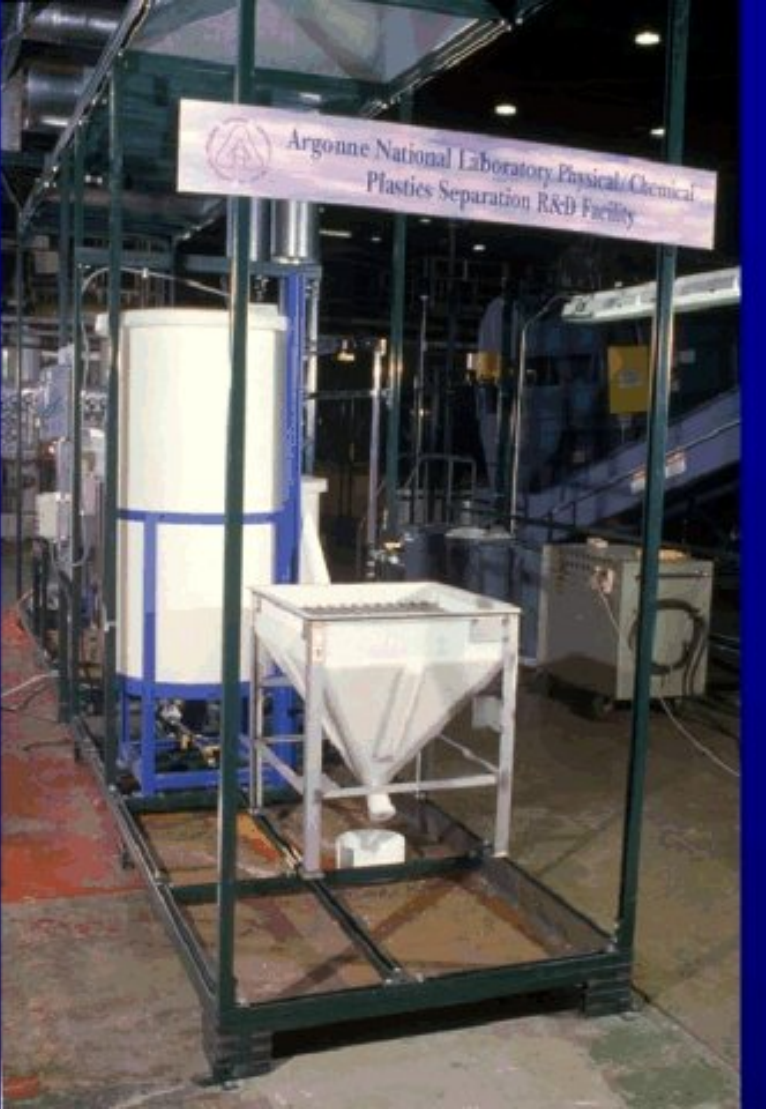
- Solution
- Solution density
- Surface tension
- pH
- Material size

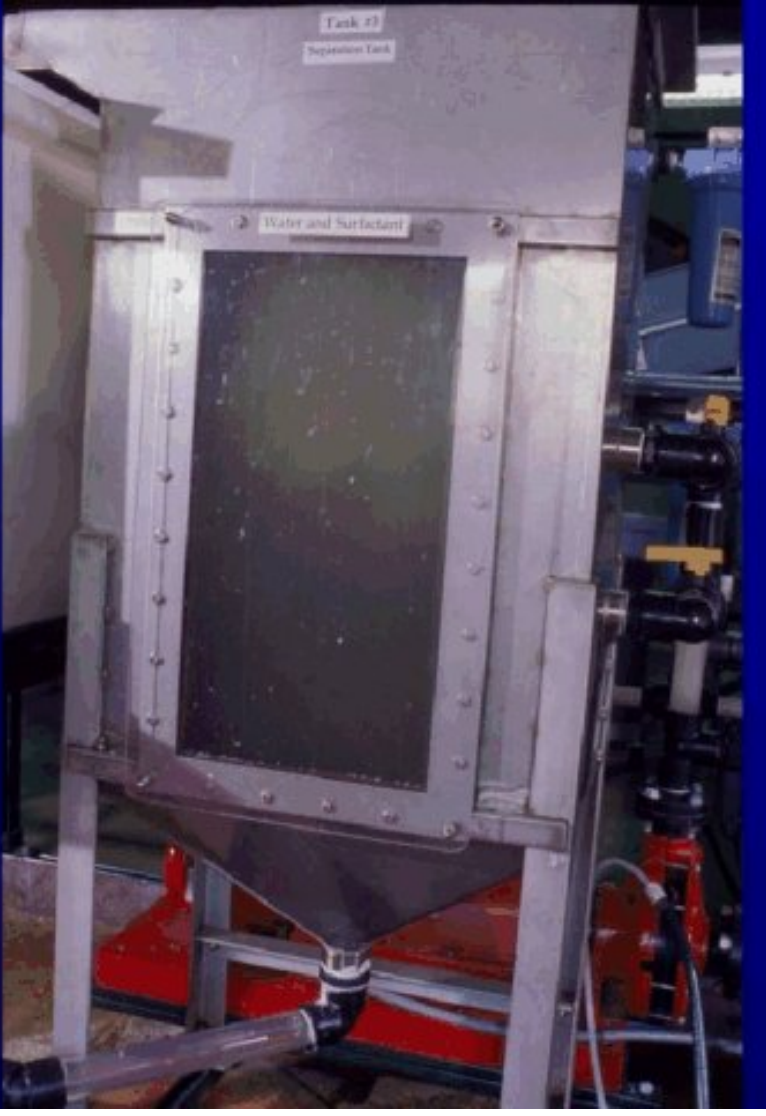
Separating ABS from HIPS: Test Results

- ABS recovered at more than 98% purity
- ABS recovery rate exceeds 88%
- Stability of solution pH, surface tension, and density maintained during tests

Photographs of Argonne's Experimental Froth Flotation Process

Argonne National Laboratory,
Argonne, Illinois


Argonne National Laboratory Physical/Chemical
Plastics Separation R&D Facility

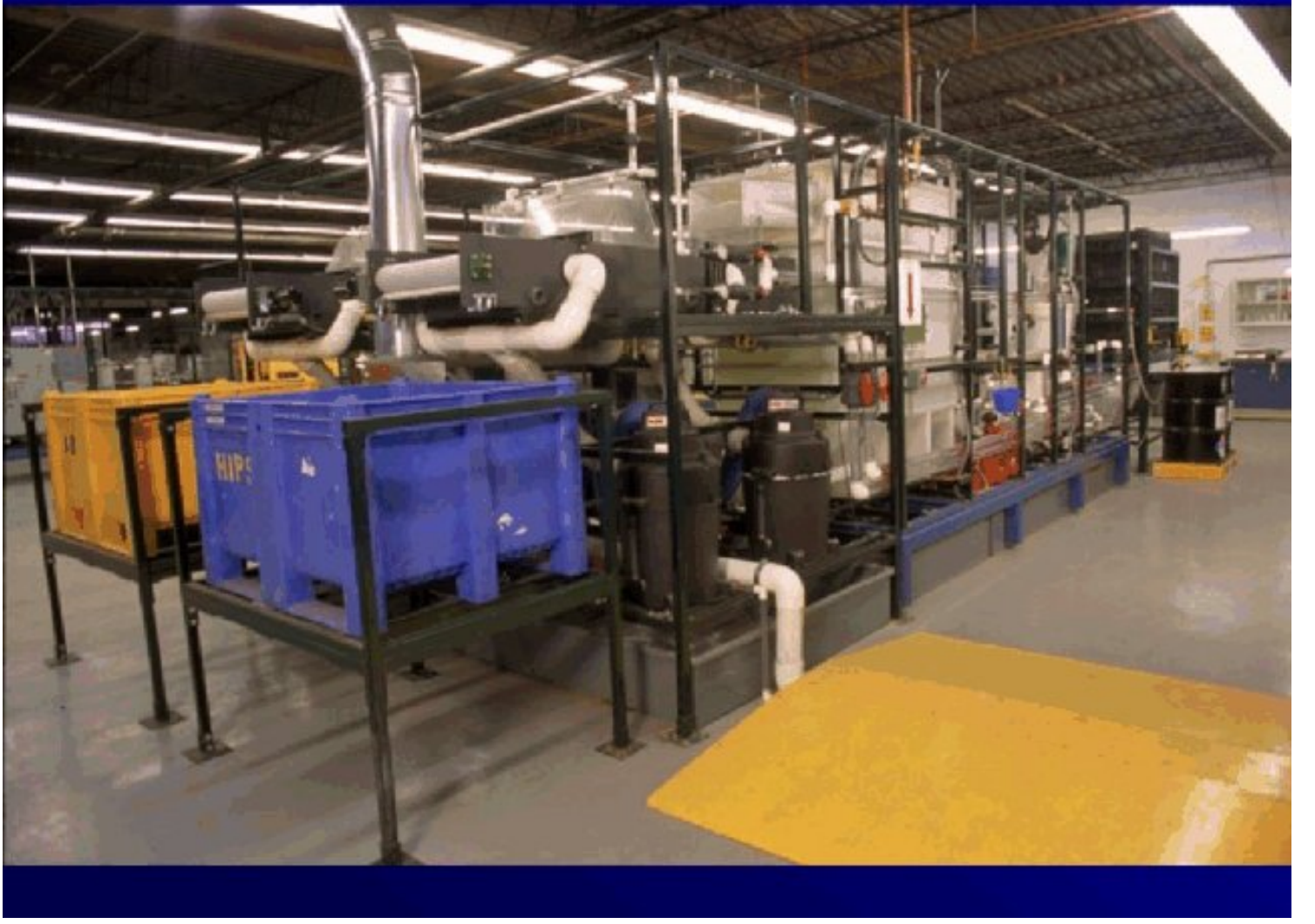

Tank #3
Separation Tank
Water and Surfactant


ABS & HIPS

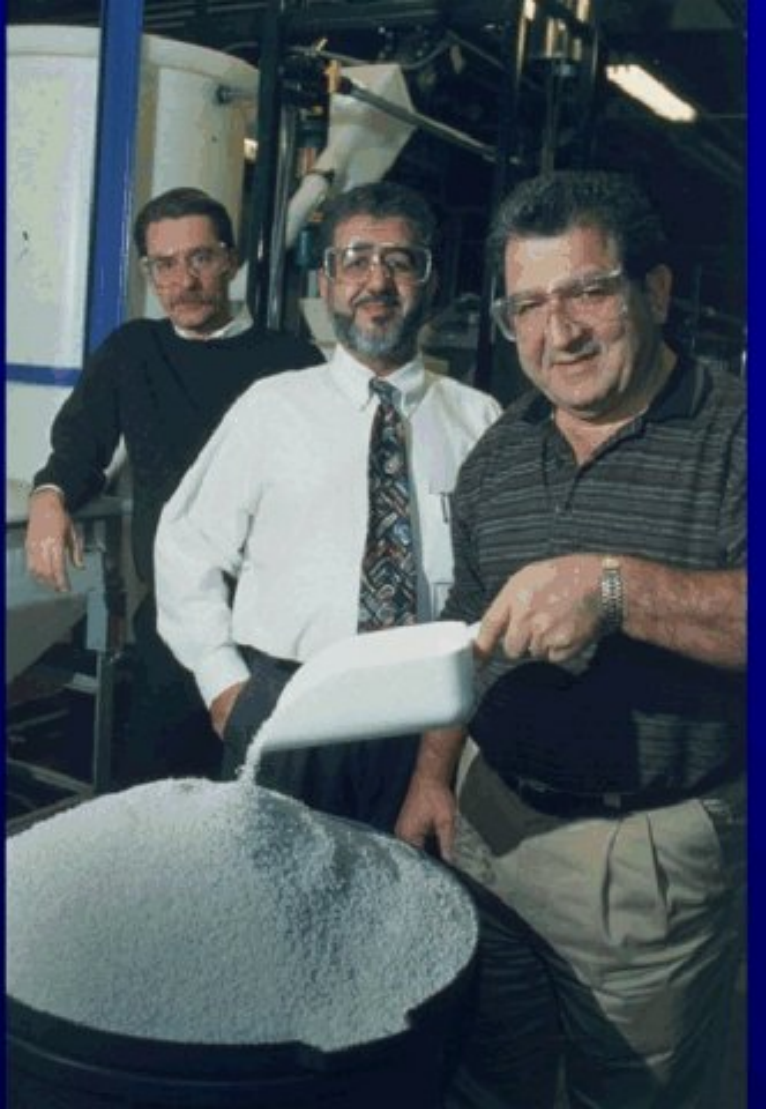
Photographs of Field Test Facility: Continuous Pilot Plant Process

Appliance Recycling Center of America, Minnesota Facility

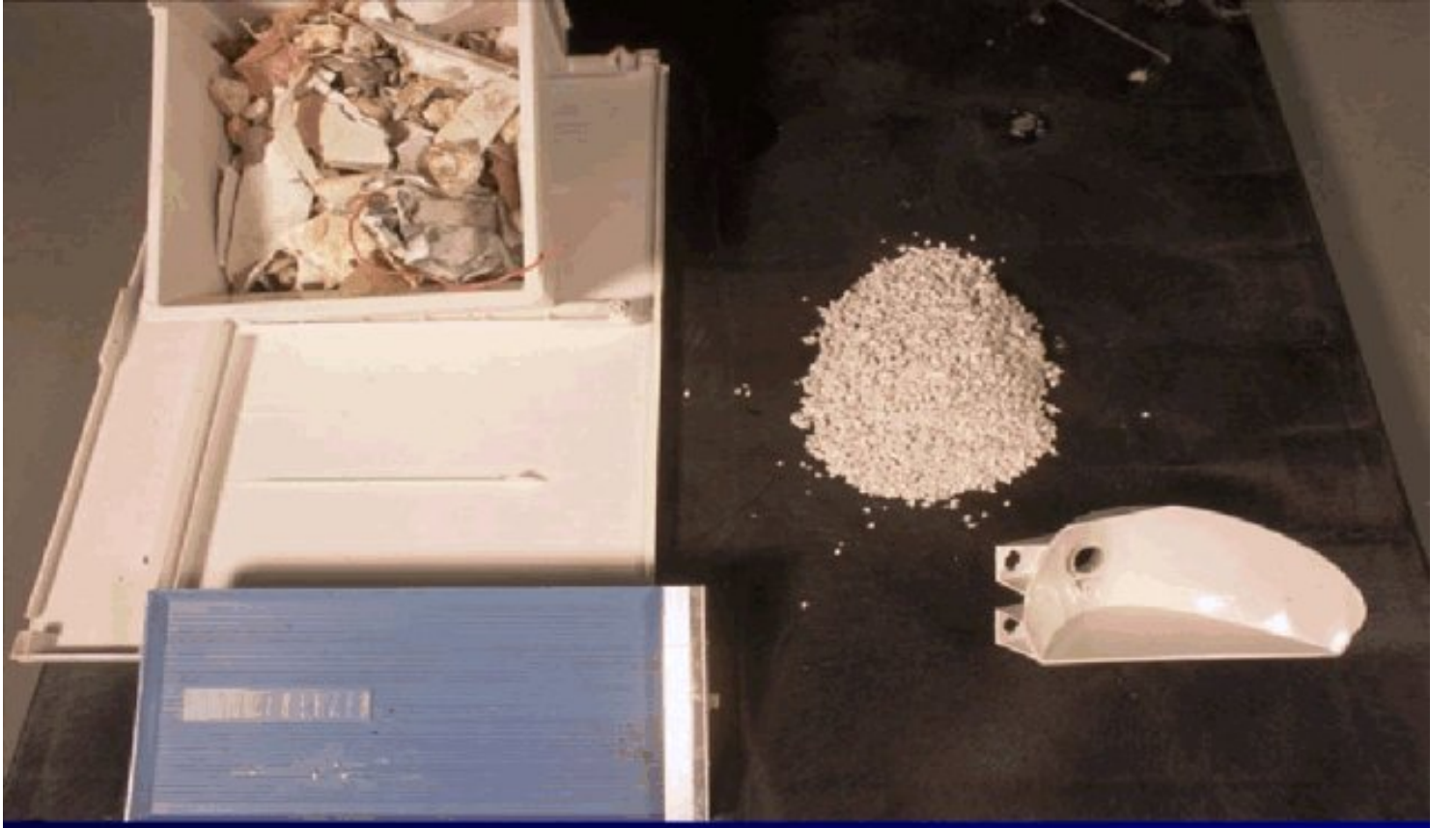

ABS
HIPS


HIPS

Photographs of Post-Consumer ABS Re-Used in Auto Parts Test



ABS recovered from obsolete refrigerators.



Upper left: mixed plastics from obsolete refrigerators. Center: ABS recovered from mixed refrigerator plastics. Lower right: Backcan for auto headlight assembly.

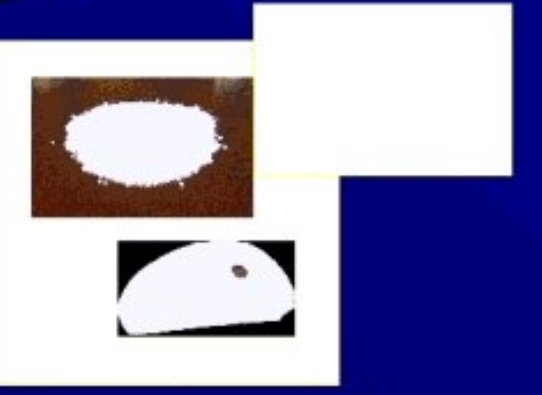
Injection-Mold Tests Confirm Feasibility of Re-Use of 100% Post-Consumer Plastics in Automotive Applications

Recovery of ABS from Mixed Plastics Waste Stream

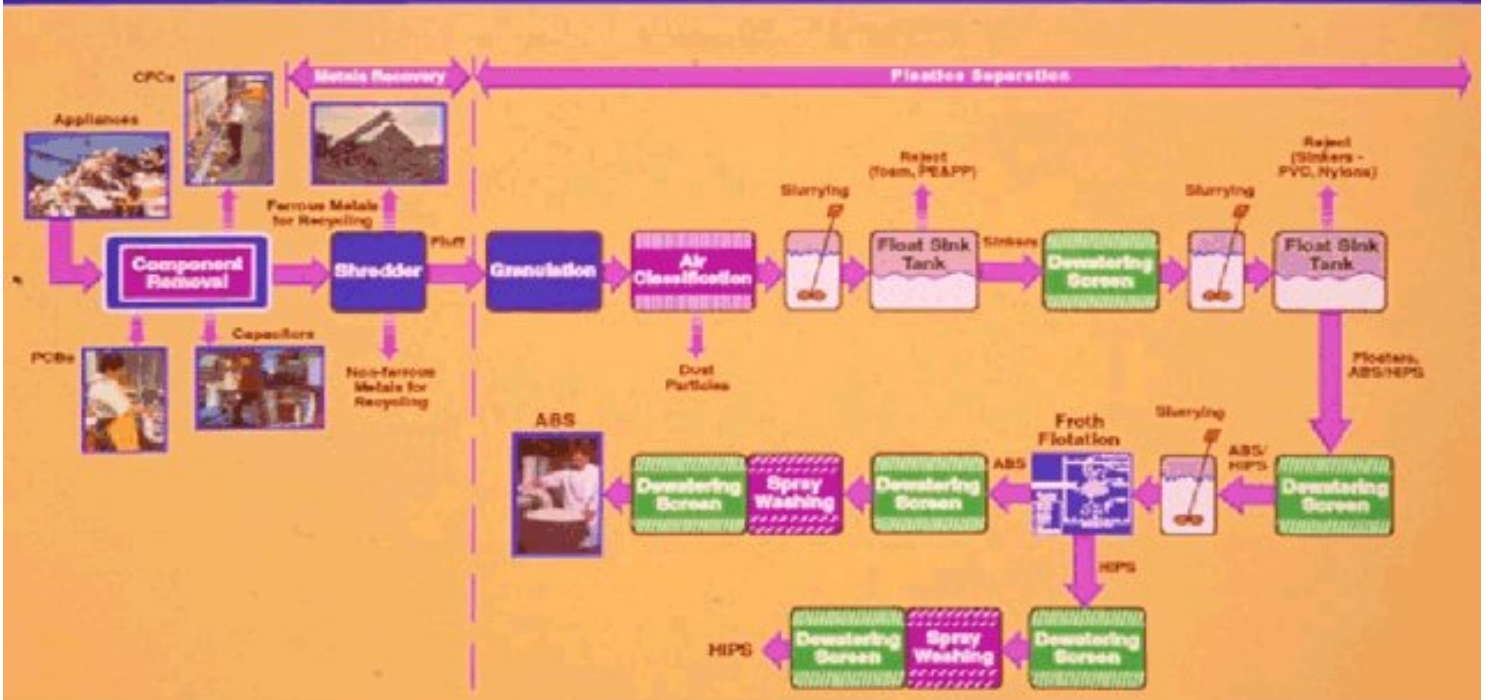
Mixed Waste Plastics

Patented Argonne Plastics Separation Process

Pure >99% + ABS Recovered



Recovery/Separation of Materials From Obsolete Appliances



Conceptual design of complete process. Left portion done by appliance recycler. Right portion is Argonne's process.