

# High-Speed Identification and Sorting of Plastic Resin Flake for Recycling

## National Recovery Technologies, Inc.

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### Environmental Problem

Postconsumer plastics have become a tremendous burden on waste disposal systems. Transport and disposal to landfills is very expensive because of the light weight and large volume. Disposal of plastics in landfills can be considered environmentally unsound because of their high resistance to degradation over time. EPA has recommended recycling of plastics as a preferred approach over incineration and landfill disposal. High-end recycled plastic resins typically are combined with virgin resins and used in manufacturing new products. To use these resins in new products, however, it is extremely important that the flake product during the recycling process be as pure and clean as possible. A large portion of recycled plastics is from postconsumer packaging materials, many of which contain mixed polymers. Mixed polymers do not recycle well, so they must be cleanly sorted to have a wide range of uses.

### SBIR Technology Solution

With support from EPA's SBIR Program, National Recovery Technologies, Inc. (NRT), developed

FlakeSort™, a sorting system used for preparing a high-quality plastics resin material from recovered postconsumer plastics packaging materials. The FlakeSort™ system is the world's first sorting system designed to make high-accuracy, small particle, polymer-specific identifications and sorts in industrial feed streams of polymer flakes or pellets.

The FlakeSort™ system is a field-tested, industrial duty, computerized process combining leading-edge, polymer-specific infrared spectroscopic detection with proprietary high-speed identification algorithms to scan and classify polymer flakes or pellets fed through the unit at high volumes. The process employs precision air jet ejection to sort particles of a selected polymer or polymers from the feed stream using a binary sort approach. High-speed proprietary polymer-specific infrared spectroscopic sensing technology provides significantly improved performance over nonspecific technologies such as X-ray-based systems.

The system uses an array of specialized wavelength-dispersive infrared detectors to read spectral characteristics of plastic flakes as they pass at high speed through a detection zone. The infrared spectral information derived by the detectors is fed to an industrialized computing system for digitization and processing. The technology can spectrally measure and sort contaminants from up to 15,000 plastic flakes per second. The identification and sorting technology is independent of flake thickness, resulting in highly accurate performance. The system is designed for ease of use and incorporates a color touchscreen operator interface for presenting

operating status and diagnostics data and for accepting operator input. Additionally, the system incorporates modem connectivity, providing worldwide factory diagnostics and software upgrades.

### Commercialization Information

The first FlakeSort™ system was sold and installed in the Midwest to NRT's Phase III partner during participation in the SBIR Program. This installation has provided a valuable test and evaluation site for the technology in a production setting. Lessons learned from this installation led to a more user-friendly second-generation product. These new units now are in operation and give excellent performance. Data show a measured 93%



Second-generation FlakeSort™ unit installed in a recycling facility near Venice, Italy.

reduction of polyvinyl chloride contamination in product resin from facilities that have used the system. The company has sold installations of the Flake-Sort™ system to plastics processing facilities in the United States and Europe. These systems operate on a continuous basis and each processes nominally 5,000 lb/hour of polyethylene terephthalate (PET) flakes.

### Company History and Awards

NRT is a major worldwide supplier of automated bottle sorting systems using X-ray and infrared spectroscopic technology. Located in Nashville, Tennessee, NRT was formed in 1981 and has 14 full-time employees. The company owns or holds exclusive licenses for 21 U.S. patents and 5 foreign patents. Numerous other patents are pending or are in the application stage. NRT has won various awards, including EPA's Award for Outstanding Achievement by a Small Business Enterprise in 1991, and a Tibbett's Award for "Recognition of Outstanding Contributions to the SBIR Program" in 1996.



The majority of the world's recycled PET plastics are processed through sorting machines developed, manufactured, installed, and serviced by NRT. NRT inspection equipment is in operation at facilities in the United States, Canada, Mexico, Europe, Japan, and Australia. The company has agents in Europe and Japan, with approximately one-half of NRT's business being export.

## SBIR Impact

- A large portion of recycled plastics is from postconsumer packaging materials that contain mixed polymers, which do not recycle well.
- National Recovery Technologies, Inc. (NRT) developed the world's first sorting system designed to make high-accuracy, small particle, polymer-specific identifications and sorts in industrial feed streams of polymer flakes or pellets.
- The FlakeSort™ system can spectrally measure and sort contaminants from up to 15,000 plastic flakes per second independent of flake thickness, resulting in highly accurate performance.
- The majority of the world's polyethylene terephthalate (PET) plastics are processed through sorting machines developed, manufactured, installed, and serviced by NRT.