

Argonne National Laboratory Materials Separation Research Facility

Argonne National Laboratory has extensive facilities for developing, validating, and demonstrating materials separation processes focused on recovery of ferrous and non-ferrous metals and polymers.

We have state-of-the-art large-scale facilities to conduct materials separation and recovery R&D that enables verification of process performance and operating conditions at pilot-scale. These facilities include: 1) a mechanical separation/size reduction facility that has the capability to process bulk materials such as e-waste to separate and recover metals and to size reduce the materials to enable subsequent separation of the mixed materials such as plastics concentrates and 2) a two-stage elutriation/froth flotation system in which specific materials including metals and polymers are recovered.

The mechanical system includes a shredder, granulator, air classifiers, magnetic pulleys and an eddy current separator. The mechanical system has a design capacity of about 1-2 t/hr depending on composition of the feed materials. The flotation system includes separation tanks, materials handling equipment, solution storage and recovery tanks, and spin dryers for rinsing and drying recovered products. When operated in a continuous mode, the flotation system has a design capacity of about 2000 lb/hr feedrate.

Our large-scale facilities are supported by bench-scale laboratories for the development of initial process conditions and for the characterization of materials. These include: (1) analytical equipment including plastics identification and analysis equipment, (2) electron microscopy facility, and (3) laboratory-scale equipment for development of separation process operating conditions.

Materials streams that can be processed in our facility include shredder residues, disassembled consumer durables parts and subsystems (e.g. automotive parts, consumer electronic parts), appliance scrap, bulk and processed e-Waste, other mixed materials content waste streams such as plastics manufacturing process scrap, and preprocessed MSW.



Experimental set-up of a single-stage flotation/elutriation tank at Argonne.

The single-stage separation tank (foreground) provides the capability for determining optimal process conditions for the selective separation and recovery of polymers from mixed plastics derived from obsolete equipment. When operated in a continuous mode, this tank has a design capacity of about 2000 lb/hr of mixed plastics. In the experimental set-up, mixed plastics are feed by a screw feeder (at left) and fed into the top of the tank. The mixed plastics are then separated into two fractions—a product fraction and a residual fraction. The residual fraction would then be conveyed to the next stage of separation (depending on the composition of the residual fraction) and the product fraction would be spun-dried and prepared for shipment.

ANL Materials Separation Facility Equipment List

- Untha sheer shredder with 7/8", 5/8", and 1/2" screens; capacity - 2 ton/hr, bulk materials feed
- Granutec plastics granulator with 3/8", and 1/4" screens; capacity - 1000 lb/hr mixed polymer feed
- Dings eddy current separator; capacity - 2 ton/hr feed
- Dings magnetic drum separator; capacity - 2 ton/hr feed
- Rotex dual deck screener; capacity - 1 ton/hr feed
- Kice lab-scale air classifiers; capacity - 100 lb/hr feed
- Small-scale wet separation system; capacity - 100 lb/hr feed
- Full-scale wet separation systems; capacity - 2000 lb/hr feed
- Carter Day continuous centrifugal dryers; capacity - 1000 lb/hr feed
- Screw conveyors, belt conveyors, load hoppers, product hoppers, other materials handling equipment