Technology Brief

USING RECYCLED PLASTICS IN AN INJECTION MOLDING PROCESS

Background

This technical assistance project consisted of two elements: (1) testing the use of recycled plastic in an injection molding process; and (2) conducting a survey of injection molding companies in Colorado about recycling issues.

The testing involved using both injection grade plastics and bottle grade recycled plastics, with the aim of helping to develop and expand the potential market for locally produced, recycled, injection grade plastics. The testing included processing trials of the recycled plastics in an injection molding process, and laboratory testing of the recycled-content parts to determine their strength and melt flow characteristics.

The survey consisted of questions aimed at identifying the market potential and requirements for using recycled injection grade plastics in existing injection molding manufacturing.

Process Testing

The process testing was conducted at a contract molding facility, Techworks (located in Denver, CO), on a total of 13 samples, including recycled bottle grade high density polyethylene (HDPE) flake from two different suppliers, mixed with injection grade virgin HDPE pellets. The feedstock mixes were tested at 20% flake, 40% flake, 60% flake, and 100% flake.

Processing tests were also conducted on several injection grade plastics samples, including repelletized post-consumer HDPE, repelletized post-industrial polypropylene (PP), post-consumer dairy tub containers in flake form [(mixed HDPE and LDPE (low density polyethylene)], post-consumer HDPE buckets and crates in flake form, and post-industrial PP in flake form. All sample materials were processed in a commercial scale injection-molding machine, using a non-proprietary mold as a testing mold. All material samples were also sent to a testing laboratory for tensile strength, melt index and impact strength testing.

Key Words

Materials: Post-consumer and post-industrial HDPE, LDPE, and PP flake.

Technologies: Injection molding.

Applications: Injection molded parts.

Market Goals: Increase use of recycled plastics.

Abstract: Testing the use of recycled plastic feedstocks in injection molding processes.

Results

Information provided by the facility indicated that all of the bottle grade HDPE mixes processed adequately with similar processing conditions and times. Both of the repelletized samples (HDPE and PP) also processed

sufficiently. Processing results of the remaining samples (with flake from dairy tubs, buckets, crates, and post-industrial PP) were unsuccessful, apparently due to various contaminants in the samples.

The property testing results for the HDPE flake and virgin pellet mixes showed increasing tensile strength and impact strength along with decreasing melt flow as the percentage of recycled flake was increased. This is because the flake were from bottle-grade HDPE, which typically has higher strength and lower, or fractional melt flow value compared to injection grade HDPE.

Because the HDPE blends followed a fairly consistent pattern of increasing tensile and impact strength and decreasing melt flow with increasing percentage of bottle-grade flake, the tests do indicate that predictable strength and melt flow could be obtained from a mix of the recycled bottle-grade flake and injection grade virgin pellets. This finding indicates that a manufacturer could use recycled flake to prepare a feedstock with desired characteristics for a specific injection-molded application.

The repelletized post-consumer HDPE showed strength test results comparable to that of the post-consumer flake with a noticeably higher melt flow value. The repelletized post-industrial PP showed low strength for PP resin, and a melt flow similar to the HDPE flake materials. The post-consumer dairy tubs in flake form (mixed HDPE and LDPE) were not tested due to significant contamination of the sample in the form of glass, aluminum, and other metal. The post-consumer, HDPE buckets and crates in flake form tested a low strength value, and the post-industrial PP in flake form tested within the expected range for strength and melt flow.

Conclusions/Survey Results

The test results indicated that the physical properties of the plastics are within usable ranges for the resin types, and comparable with their virgin resin equivalents. The remaining issue for successful use of these types of recycled plastic is the consistency of supply. Typically, recycled plastics can vary significantly from batch to batch, in strength, melt flow, color, and contaminant levels, causing processing and quality problems for manufacturers. Significant variation was seen between the recycled HDPE flakes provided by two different suppliers, although both samples were supposedly from post-consumer HDPE bottles. Additional testing of multiple samples over time would be required to determine the variability from suppliers of the recycled plastics tested in this project.

Survey results from injection molders and extrusion molders indicated that a potentially substantial market for recycled plastics exists in the Colorado plastics manufacturing community. About one-third of respondents said they would consider using a technical assistance program, in such areas as obtaining a reliable supply of consistent recycled feedstock, technical information on the properties of and procedures for using recycled materials, and assistance in finding markets for internally-generated regrind materials.

Fact Sheet Update: March 1999

For More Information

For a copy of the report, *Plastics Recycling Technical Assistance Report*, use the CWC Publication Order Form, or call (206) 443-7746. For more information call CWC at (206) 443-7746, email info@cwc.org, or visit the CWC Internet Website at www.cwc.org.

This technology brief was prepared by **CWC,** Managing Partner of the **Recycling Technology Assistance Partnership (ReTAP)**. ReTAP is an affiliate of the national Manufacturing Extension Partnership (MEP), a program of the U.S. Commerce Department's National Institute of Standards and Technology. ReTAP is also funded by the U.S. Environmental Protection Agency.

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