

Introduction

Polymer science involves several scientific disciplines: organic chemistry, colloidal science, and biochemistry. Polymer molecules, including plastics, resins, proteins, lattices, and nucleic acids, fall into the category of high-molecular-weight species composed of repeating units of smaller molecules. These substances have in common an origin of natural or synthetic organic sources.

Processing

Of interest is the production and application of synthetic polymers used in many products that are part of everyday life. All the materials termed plastics have in common a process whereby a small molecule (monomer) under proper conditions can be linked to identical or similar molecules to produce a very large molecule (polymer). In some applications, the polymer is produced in the form of pieces, or pellets. Materials of this size possess properties that allow downstream processing equipment to operate most efficiently.

The Problem

Many types of process equipment are used for manufacturing plastics, including injection moulds, compression moulds, extruders, and rotational moulds. A common characteristic of all these processes is that a pellet or powder is used as the starting material. The characteristics of the feed material must meet certain criteria, such as melting point. In addition, chemical composition, flexural strength, compressive strength, impact resistance, density, chemical resistance, and tensile strength give the resulting workpiece its characteristics. The particle size of the pellets contributes significantly to processability of the polymer. Flowability from the hopper and melting rate when heated, have a direct effect on process speed. Particles (pellets) are generally produced in the range of 200 to 2,000 microns for transport and application.



The Solution

The Microtrac® MRB S3500 Particle Size Analyzer ensures accurate particle size measurement in the 0.02 to 3000-micron range. As shown in Figure 1, the data for a thermoplastic product or polymer spheres can be presented graphically. To enhance the capability of laser diffraction measurement, the data may be stored in the computer for later retrieval. Data is stored in true MS-ACCESS using Microtrac FLEX software. This makes data retrieval easy. In addition to easy data retrieval and analysis from within the FLEX analysis software, more advanced data analysis can be performed with standard programs such as Excel. Data can be automatically exported in many common formats for either desktop or LIMS applications.

For polymer materials that are larger than the measurement range that can be accommodated by the the S3500, the Microtrac MRB Dynamic Image Analyzers of the CAMSIZER series are recommended. These instruments cover a size range from 20 μ m to 13.2 mm and also provide particle shape information including a unique 3D-analysis. This is perfect for larger polymer pellets in the millimeter size range.

Thermoplastic Material								
- Summary -		- Size % -		- Percentiles -		- Peaks Summary -		
Data item	Value	Size(um)	56Tile	%Tile	Size(um)	Dia	Vol%	Width
MV(um):	74.91	0.500	0.00	10.00	10.04	47.67	100.0	129.90
MN(um):	6.91	10.00	9.94	20.00	17.22			
MA(um):	25.17	50.00	51.60	30.00	25.36			
CS:	2.38E-01	100.0	73.33	40.00	35.29			
SD:	64.9500	300.0	98.21	50.00	47.67			
		500.0	100.00	60.00	64.32			
		700.0	100.00	70.00	89.20			
		900.0	100.00	80.00	125.8			
		1200	100.00	90.00	179.3			
		1400	100.00	95.00	227.0			





Fig 1.: Microtrac S3500 data displayed using advanced FLEX software with 3-D graphics







Fig. 2: Schematic of Tri-Laser optical system of S3500. Patented Tri- Laser silicon detector array covers scattered light sensing from 0 to 163 degrees for optimum fine particles detection.



Fig.3: Microtrac S3500 with Sample Delivery Controller (SDC) for fluid suspension and the Turbotrac (top) for dry powder measurement.





Microtrac S3500 Capabilities:

- Patented Tri-Laser silicon detector array covers scattered light sensing from 0 to 163 degrees.
- Measures multimodal distributions using Modified Mie scattering calculation which compensate for false fines modes due to refraction from spherical particles and compensation for non-spherical particle shapes.
- Full database management capability exportable to all popular spreadsheets and database managers
- Convenient, portable small size
- Completely automated or manual operation
- Wide particle size measurement range (0.020 2800 microns)

