


Carbon Black Differentiation

Using the Multi-range Method in the MIR Range



Differentiation of Carbon Black Plastics in the Recycling Industry

During the sorting process, after the extrusion process and before or during the dosing process.

A Strong Consortium

In order to produce a flawless recyclate, it is necessary to intervene at various points. We monitor your product throughout the entire recycling process, from sorting to the final product.

Together with our partner companies, we ensure the best possible product quality.



Carbon Black Plastics in the Automotive Industry

The proportion of carbon black plastics in industry is likely to be around 1/6 of the total proportion of plastics. Black plastics are predominantly used in the automotive sector, the electrical industry and the construction industry, in particular.



Frequently Used Plastics in the Automotive Industry

- **PP:** This plastic is very versatile and is often used for bumpers, instruments panels and cable insulation.
- **PUR:** Is often used for seats, upholstery and seals.
- **ABS:** A robust plastic used for parts such as radiator grilles and interior trim.
- **PVC:** Often used for cable sheathing and interior cladding.
- **PC:** This plastic is often used for headlight covers and other transparent parts.



Acrylnitril-Butadien-Styrol (ABS)



Polyurethan



Chlorkohlchlorid (PVC)



Polycarbonat (PC)

Black Plastics in the Construction Industry

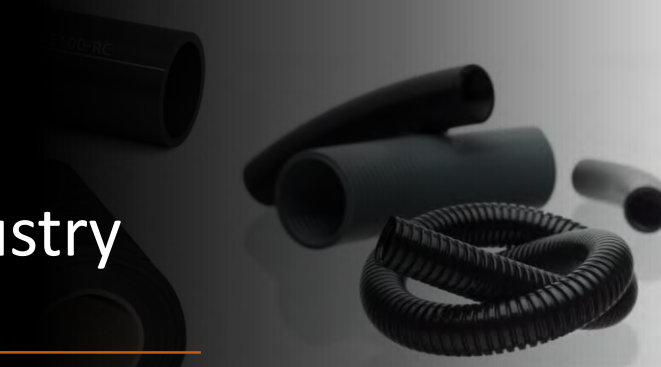
Plastics are increasingly being used in the construction industry. In Europe, the construction sector consumes around 10 million tons of plastics per year (around 20% of total European plastics consumption).

Plastics are often used in the construction industry to manufacture pipes, insulation, window frames and floor coverings. Black plastics are often used because of their UV resistance and durability.

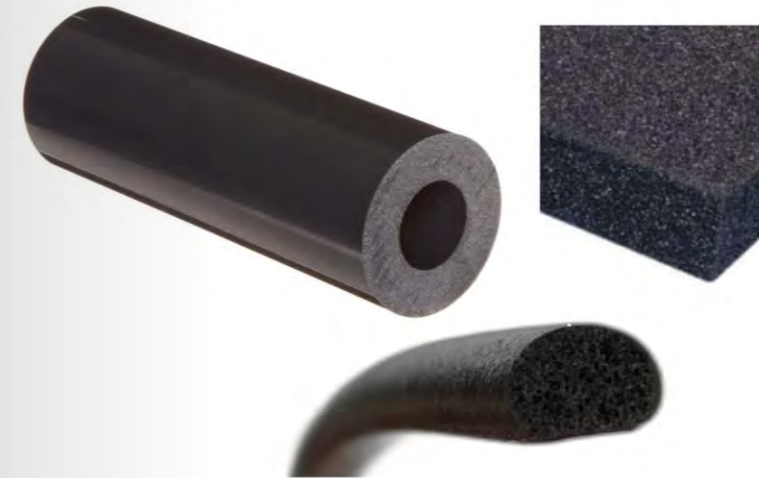


Main Applications of Important Plastics in the Construction Industry

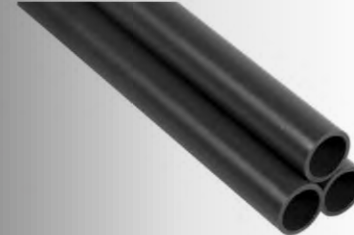
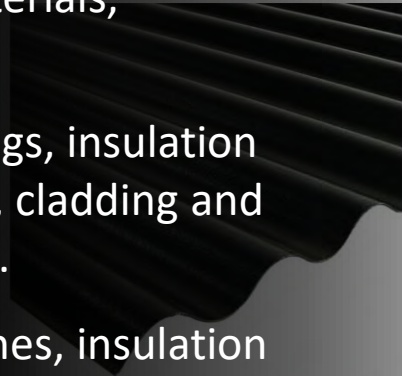
- **PVC (polyvinyl chloride):** Pipes and fittings, window frames and doors, floor coverings and roof sealants.
- **PUR (polyurethane):** Insulation materials, adhesives and sealants, coatings.
- **PP (polypropylene):** Pipes and fittings, insulation materials, air and moisture barriers, cladding and carpet textiles, adhesives and tapes.
- **PE (polyethylene):** Pipes and pipelines, insulation materials, vapor barriers and construction films, geotextiles.
- **EPDM (ethylene propylene diene monomer):** Roof waterproofing, facade waterproofing, seals and membranes, insulation material.



PE (Polyethylen)



PUR (Polyurethan)



PVC (Polyvinylchlorid)

Black Plastics in the Electrical Industry

Black plastics play an important role in the electrical industry, particularly due to their specific properties and applications:

- **UV resistance:** Black plastics offer high UV resistance, which makes them ideal for outdoor use.
- **Aesthetics and design:** Black plastics are used in many electronic devices for aesthetic reasons, as they give a modern and elegant look.



OVEN



VACUUM
CLEANER



MICROWAVE



AIR
CONDITIONING



COFFEE
MAKER



LAWN MOWER



FAN



BARBECUE



HEATER

Areas of Applications for Black Plastics in the Electrical Industry

- **ABS (acrylonitrile butadiene styrene):** Electronic housings for computers, monitors and household appliances, cable ducts and sockets, protective covers.
- **PA (polyamide):** Cable insulation, connectors and housings, circuit breakers and fuses, cable ties.
- **PBT (polybutylene terephthalate):** Connectors and switches, housings and covers, button caps, wall boxes.
- **PC (polycarbonate):** Housings and covers, connectors and switches, circuit breakers and fuse boxes.
- **TPU (thermoplastic polyurethane):** Cables and wires, protective covers, seals and sealing tapes, flexible hoses.



PA (Polyamid)

PBT (Polybutylen)



TPU (Thermoplastisches Polyureth)

Recycling of Carbon Black Plastics

Sorting carbon black plastics poses a particular challenge, as they are invisible to many conventional sorting systems due to their specific absorption behavior.

In the mid-infrared range (MIR), on the other hand, the light from black plastics is absorbed only slightly more than that from lighter-colored products. MIR technology therefore makes it possible to effectively differentiate and separate black plastics.



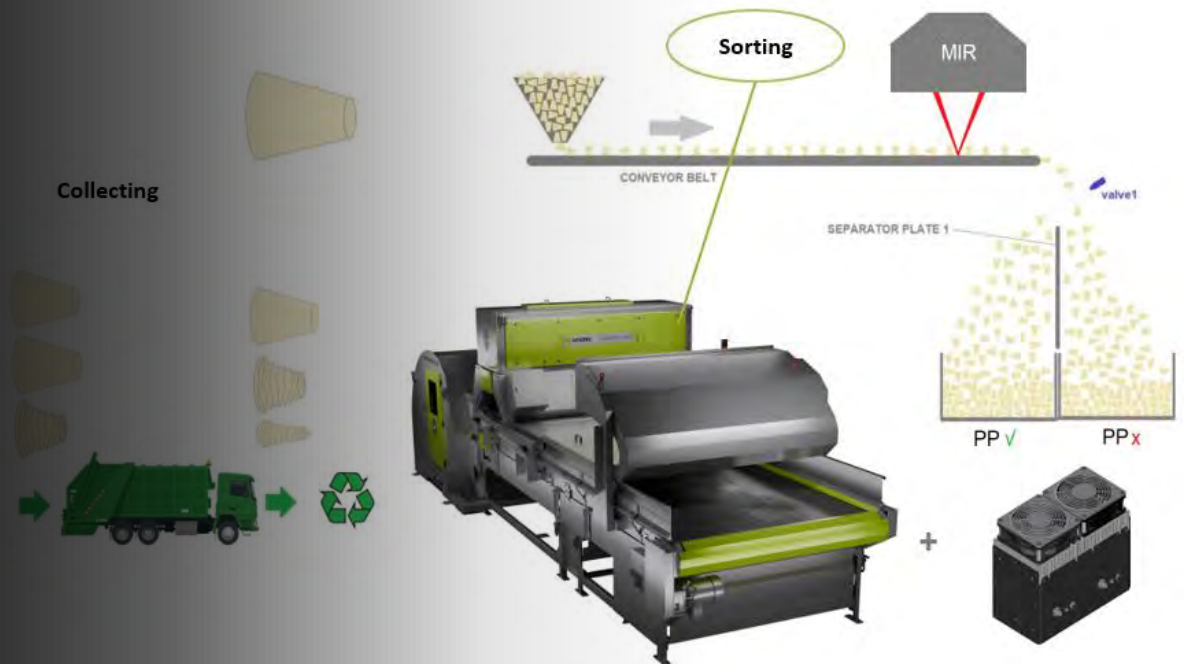
Sorting of Carbon Black Plastics

In the automotive sector, the items are first roughly shredded, washed and then sorted in the recycling plant.



The Sorting Process

The MIR sensor system from Sensor Instruments recognizes the different types of plastic and passes this information on to the sorting system.



Recyclate Control after the Extrusion Process

After the sorting and shredding process, the cleaned particles are fed into the extrusion system. Immediately after the extrusion process, the recyclate produced is checked on the vibrating chute using MIR sensors.



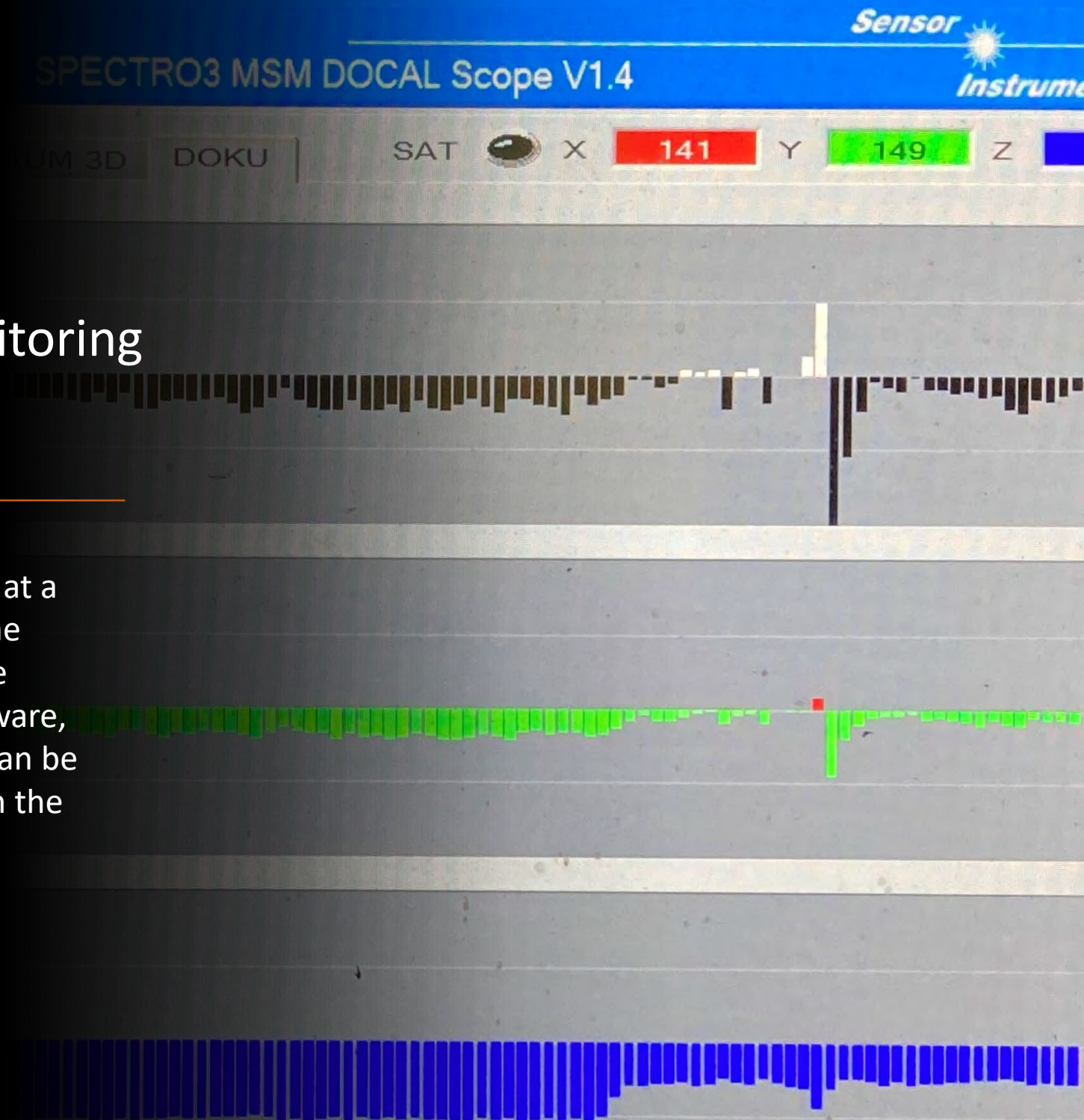
The Extrusion Process

After the sorted, shredded and cleaned plastic fraction has been melted, a final check is carried out on the vibrating chute immediately before the recycle is filled into the big bag.



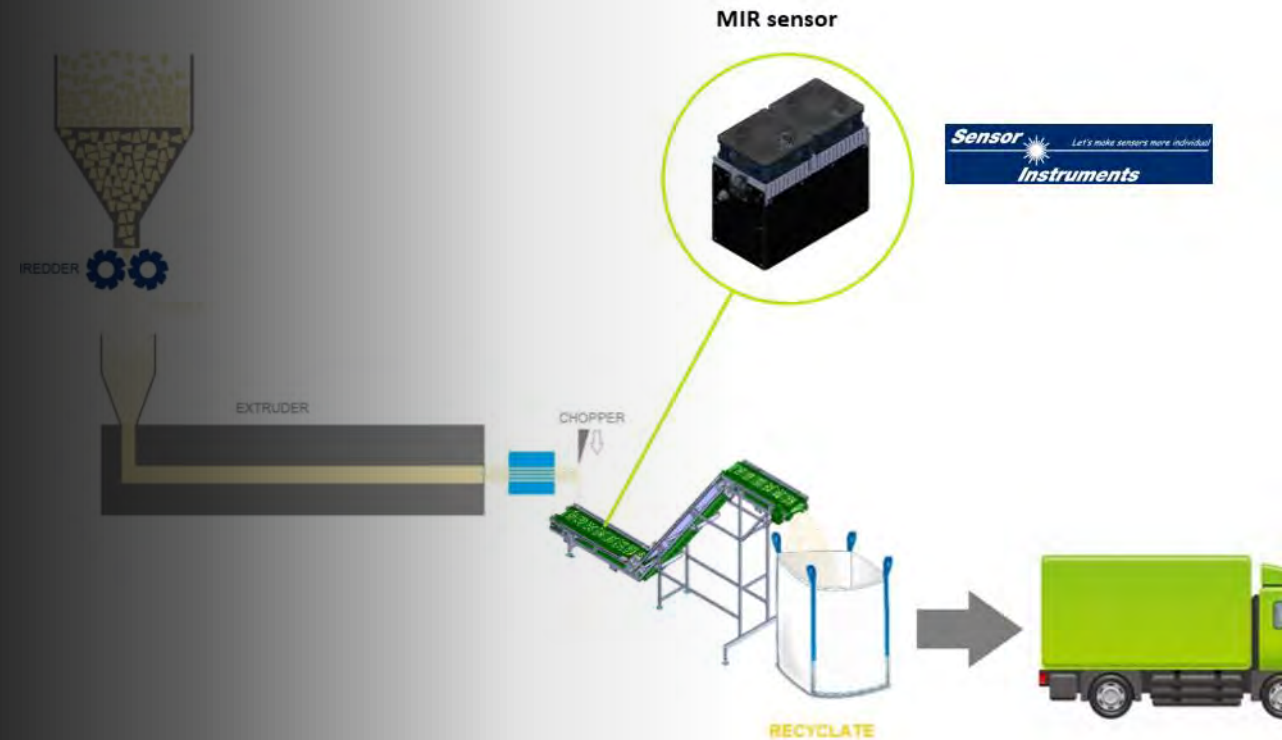
Recyclate Output Monitoring Using MIR Sensors

The MIR sensor system is mounted at a distance of approx. 120mm from the recycled material surface. Using the DOCAL Windows® monitoring software, the trend of the measured values can be read graphically and numerically on the monitor and the data recorded.



Final Process in the Recycling Company

Once the recyclates have been filled into the big bags, they are transported to the customer.



RECYCLING COMPANY

Recyclate Processing

In the plastics processing plant, the recyclate is first checked in the silo. The MIR sensor system is directed at the recyclate through a suitable sight glass. By moving the recyclate, the measuring accuracy can be increased by a factor of 10, as the random position of the individual pellets can be averaged.



The MIR Sensor System SPECTRO-M-3

The sensor system has a stabilized integrated MIR light source, consisting of eight emitters, which covers the required wavelength range of typically $2.5\mu\text{m}$ to $5\mu\text{m}$. On the receiving side, a cluster of MIR photodiodes with three different bandpass filters is used.

The three-range method is used for evaluation, analogous to $L^*a^*b^*$ color measurement. The determined $M^*i^*r^*$ triple provides information about the respective type of plastic. Similar to color measurement, the slightest impurities can be reliably detected.



The Injection Molding Process

After the recyclate has been removed from the silo, it continues to the dosing system directly in front of the injection molding machine.



Material Feed in the Plastics Industry

Material feeding in the plastics industry is a key process that ensures recyclates are transported efficiently and reliably to the processing machines:

- **Material storage:** In silos or containers.
- **Vacuum conveying:** Material transport in pipes.
- **Material feed:** The material is fed to the processing machine via suction pipes and suction lances.
- **Filtering:** Filter stations remove dust and impurities from the conveying air.
- **Control:** Monitoring and control of the entire material flow.



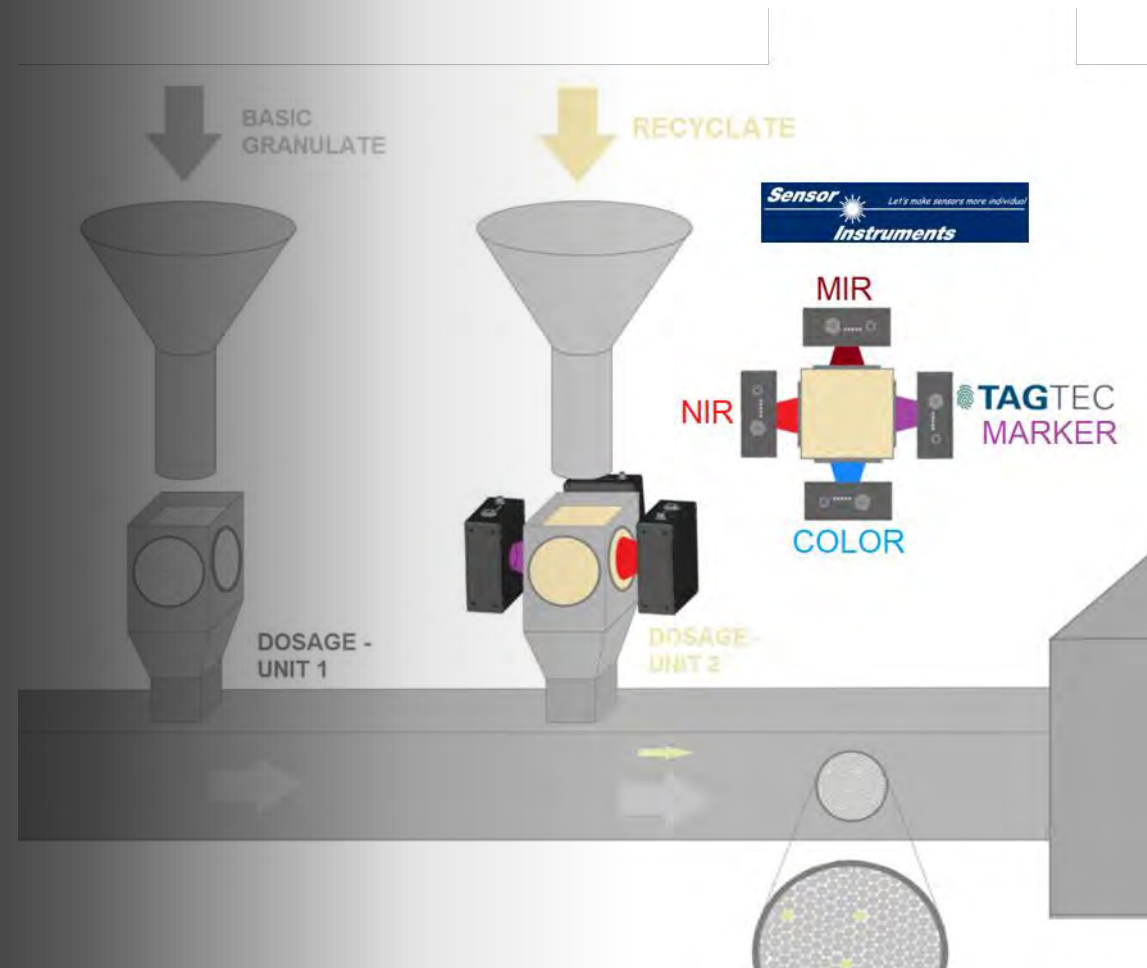
Recyclate Inspection during the Material Feeding

Recyclate can also be checked at the material feed container. The system operator is informed about the quality of the recyclate used at an early stage. Furthermore, the measurement data can be transmitted to the quality assurance department in real time.



The Dosing Process

Dosing systems are used for this purpose. The dosing systems can be individually equipped with the appropriate sensor technology from Sensor Instruments. Suitable sight glasses provide a view of the recycle present.



Gravimetric Dosing

The dosing system can be equipped with color sensors and NIR sensors. There is also the option of attaching an MIR sensor system. Luminescence sensor technology can be used for marker-based dosing (TAGTEC). The respective sensor information is processed with the help of the control unit of the dosing system.



Laboratory Measuring System for the Differentiation of Black Plastics

In addition to the inline sensor technology, sensor systems are available for the laboratory that function according to the same measuring principle and therefore provide comparable measured values.

The capacity of the hopper is approximately 10 liters; a highly accurate average value of the $M^*i^r^*$ triple is determined from this amount of recyclate during the measurement, which provides information about the respective type of plastic.



Mobile Measuring System for Checking Black Plastics

This mobile measuring system can be used to measure and check recycled material on site between the individual production lines. The measuring system has a self-sufficient power supply. The measurement data (M*i*r* values) are displayed on the monitor graphically (trend) and numerically (in the tolerance range / outside the tolerance range) and the measurement data are also recorded.



Handheld Measuring Instruments for the Differentiation of Carbon Black Plastics

Handheld devices from the SPECTRO-M-3 series are essential for the rapid on site measurement of carbon black plastics. Whether you need to check pellets, flakes, containers, films or mats, the right attachment and the SPECTRO M 3 Scope Windows® software ensure perfect control.



Mobile Control of Carbon Black Recyclate

With the MIR measuring system SPECTRO-M-3-15, a laptop and the DOCAL Windows® software, a recyclate check can also be carried out quickly and reliably on site using the glass plate attachment.

The sensor is placed on the recyclate surface at various points and an exact average value of the respective recyclate sample is obtained once the measurement is complete. By using the supplied spacer, objects such as containers or flat products such as films or mats can also be reliably detected.



Clarity in Darkness

Detect in Carbon Black

Differentiation of carbon black plastic types with analysis from MIR based multi-channel sensors

Our specialists are happy to tell you more about it

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Sensor



Instruments

Let's make sensors more individual

