Presse Release Sensor Instruments

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Clarity in darkness – Detect in Carbon Black

Differentiation of Carbon Black recyclate material using MIR

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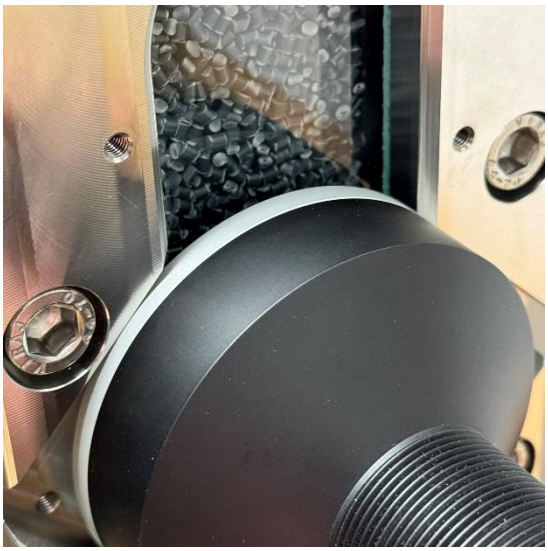
Soot-blackened plastic, like a black hole that devours all light? Not quite! Although a large proportion of the light hitting the black plastic material is absorbed in the visible and near infrared range (NIR), the absorption behavior of Carbon Black products in the mid infrared range (MIR) is rather low compared to light-colored materials. In the MIR range, therefore, a window opens that provides an insight into the type of plastic used. Different Carbon Black plastics have a characteristic spectral absorption behavior in the MIR range, which makes it possible to differentiate between different types of plastic in this wavelength range.

Up to now, black plastic has tended to be downcycled, at least in open cycles, i.e. the recycled material is no longer intended for its original use but is instead used for lesser purposes.
In view of the fact that around 1/6 of the plastic material produced each year currently consists of carbon black, there is an increasing need for action to return the recycled material to its original area of application. In the automotive industry in particular, but also in the electronics and construction industries, soot-blackened plastic is predominantly used.

At present, however, the range of sorting and separation systems for separating Carbon Black by type of plastic is still limited. This is probably preliminary due to the fact that hyper-spectral cameras suitable for the MIR range are still quite expensive and require intensive servicing. Together with partner companies, Sensor Instruments is taking an alternative approach here; the three-range method known from the visible wavelength range has been transferred to the MIR range. L*a*b* became M*i*r* and instead of measuring in the visible range (400nm to 700nm), measurements are taken in the mid-infrared range between 2.5µm and 5.0µm.
The stabilized emission spectrum of the MIR light source used, which can be arranged as a row, is similar to that of a Planckian radiator; on the receiver side, the three-range MIR detectors are also lined up in a row. This results in a dense optical grid, which enables the detection of objects

from typ. 15mm. By lining up the transmitter and receiver modules, a traverse can be constructed which can be arranged at right angles to a conveyor belt, for example. After shredding, washing, drying and separating the Carbon Black fraction in the recycling plant, it is then extruded and granulated.

The recycled material, transported onto a vibrating feeder, can then also be checked using MIR sensors. The MIRTEM-150 sensor is positioned approximately 150mm above the recyclate flow. Measurements are only taken when the vibrating feeder is switched on. Both the temperature of the sensor and the recyclate temperature are monitored. In addition, the height of the recyclate flow is measured using a laser triangulation sensor. If the recyclate flow level is too high, this indicates that the vibrating feeder screen (at the outlet of the vibrating feeder) is completely or partially blocked. The recyclate is then conveyed into the reject channel. If the level of the recyclate flow is too low, however, this indicates that too little material is being fed into the vibrating feeder. After passing through the screen, the recycled material is usually filled into a so-called big bag using a vacuum conveyor, screw conveyor or pneumatic conveying system.



After transportation to the plastics processing plant, the recyclate is first filled into the silo. By attaching a sight glass including the corresponding MIR sensor system (SPECTRO-M-3), this is the first opportunity to carry out a continuous recyclate check. Using DOCAL Windows® software and a panel PC (SI-PPC-500-15”), the M*i*r* values and their deviations from a defined reference dM*, di* and dr* can be displayed both graphically and numerically. The measurement data can also be forwarded to the quality assurance department (QA) via Ethernet. The sensor system can be connected to a PLC via Profinet® adapter. When the recycled material is delivered in bags, it is picked up via the material feed unit. A sight glass is installed at this point in the same way as on the silo.

A random recyclate check can be carried out using the offline unit (FW-CaF2-75-OFL) in conjunction with a MIR sensor unit (SPECTRO-M-3). The sensor is attached to the offline unit and immersed in the recyclate sample. The measurement data can be displayed using a tablet and the DOCAL software, for example. The MIR sensors can also be calibrated using the offline unit, the DOCAL software and the corresponding Carbon Black plastic cards (an aluminum card is provided for white balance). The calibration cards are already measured at Sensor Instruments and provided with a label (5-digit number and the M*i*r* value). Calibration is very simple using DOCAL software. After retrieving the calibration card file from the

Sensor Instruments homepage, simply enter the 5-digit number and the calibration data of the respective card is transferred to the software.

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