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Differentiation of recyclate types using NIR during the recycling process

Plastic type differentiation of recyclates using NIR

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The use of more and more recyclates in the plastic processing industry, driven not least by the EU Packaging and Packaging Waste Regulation (PPWR) with regard to the proportion of recyclates in plastics, also increases the need to carry out a check according to the type of

plastic of the respective recyclate in addition to the color check already carried out in the laboratory. There is no lack of adequate sensor technology during the sorting and separating process, as various machine builders offer sorting systems equipped with so-called hyperspectral cameras suitable for the NIR range. These are suitable for sorting whole objects as well as for separating plastic fragments and flakes. However, for economic reasons these NIR cameras are less suitable for more selective product monitoring. Discrete sensors and sensor systems, which are both very compact in design and inexpensive to purchase, are more appropriate for this purpose.
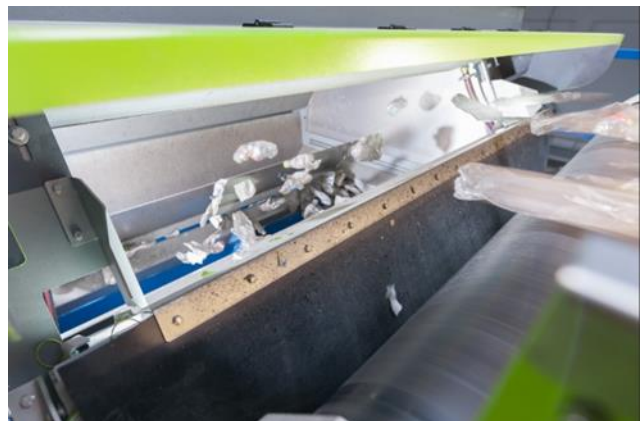
In addition to stationary laboratory devices SPECTRO-T-3-0°/45°-LAB-LF and SPECTRO-T-3-DIF/0°-LAB-LF, mobile laboratory systems SPECTRO-T-3-0°/45°-MOBILE-P and SPECTRO-T-3-DIF/0°-MOBILE-P are also available. To avoid sending the measuring systems in for regular recalibration, on-site calibration has been integrated into the devices. In addition to the aluminum card for the white balance, additional plastic cards of different plastic types are

available. Each of these cards has a 5-digit number on the label affixed to the respective plastic card and is also marked with the so-called N*i*r* values. The data of the respective card is available on a sensor file on the Sensor Instruments homepage; this file can be downloaded from the homepage. During the interactive calibration process using the DOCAL Windows® software, the N*i*r* value determined for the card can be retrieved from the file by entering the 5-digit number and recorded in the calibration table.

The NIRTEM-100 inline measuring system, which can be positioned on the vibrating feeder immediately after extrusion and pelletizing of the recyclate, is provided for continuous monitoring of the measurement data. The type of plastic in the recyclate is determined from a sensor distance of approx. 100mm. In addition, the temperature of the recyclate is determined and the integrated laser displacement sensor monitors the level of the recyclate flow. If the recyclate flow level is too high, this indicates that the screen is blocked and recyclate is unnecessarily entering the reject channel; if the recyclate flow level is too low, this indicates that the extrusion system is not providing enough material. After the recyclate material has been packed into big bags, for example, it is then sent on to the plastics processing plant. There, the recyclate is first filled and stored in silos, then usually transported via pneumatic conveyor systems or screw conveyors for drying and then to the dosing units directly upstream of the extrusion or injection molding systems. If the recycled material is delivered in bags, on the other hand, the material is fed to the so-called material feeding stations.

The steadily increasing use of recyclates for the manufacture of high-quality products increases the need for continuous incoming recyclate inspection, as a purely visual inspection of the material by the personnel makes sense in the case of possible color deviations of the recyclate, this possibility of material inspection is ruled out in the case of differences in the type of plastic, as there do not necessarily have to be visual differences in the case of deviations. The first opportunity to do this is at the silo or material feed station. A sight glass attached to the silo or material feed unit and the SPECTRO-T-3-10-DIF-NIR/NIR sensor system are used to record and evaluate the measurement data. The measurement data is further processed via Ethernet or Profinet® using PC or a PLC.

With the help of the DOCAL software, the measured values as well as the trends can be displayed both graphically and numerically, and the data can also be made available to the quality assurance department (QA) via Ethernet.
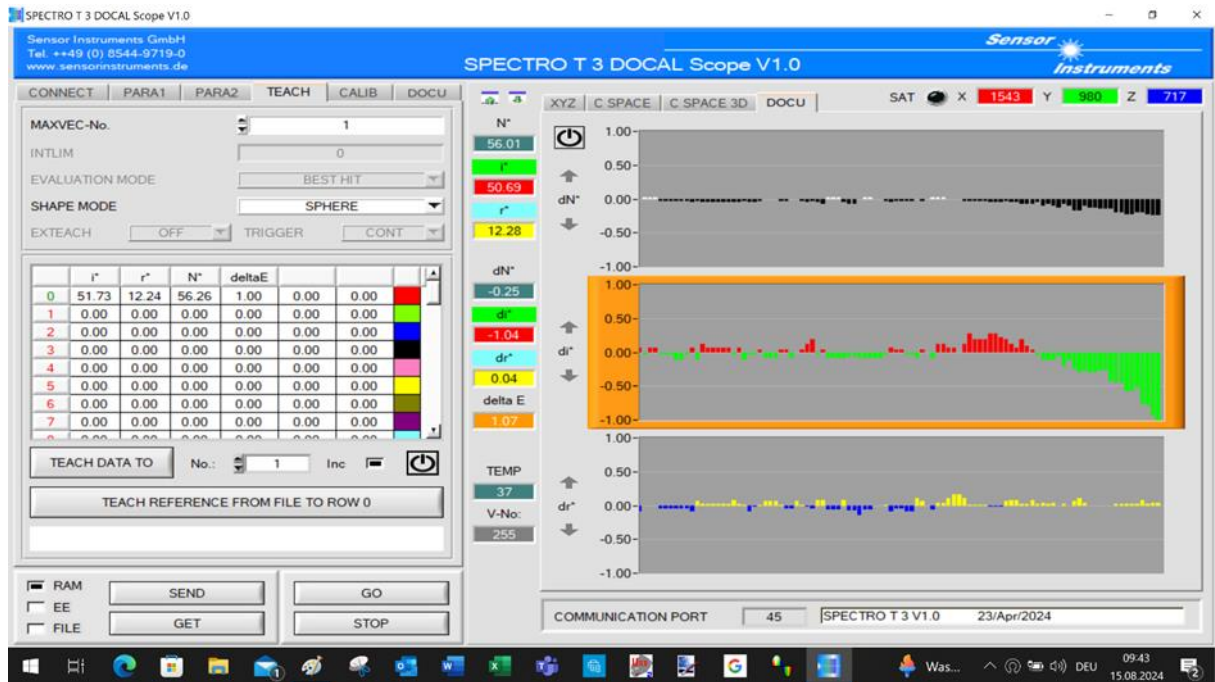
If one of the three NIR values leaves the set tolerance limits, this is clearly displayed graphically in an orange frame. The data is also stored in a file to be specified by the operator. This file can also be accessed during data recording. Another way to check the quality of the recyclate is

directly in front of the extruder or injection molding machine at the dosing unit. The type of plastic can also be checked there by attaching a sight glass and the corresponding NIR sensor. If the recycled material deviates too much from the reference values entered, the dosing unit can be used to intervene. If necessary, some virgin material can be added and recycled material can only be passed on to the downstream units in reduced quantities so that the tolerances dN*, di* and dr* can be maintained. In addition to the graphical display of the N*i*r* measured values and their deviations dN*, di* and dr* from the entered reference, the DOCAL software can also be used to select the numerical display format.

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