



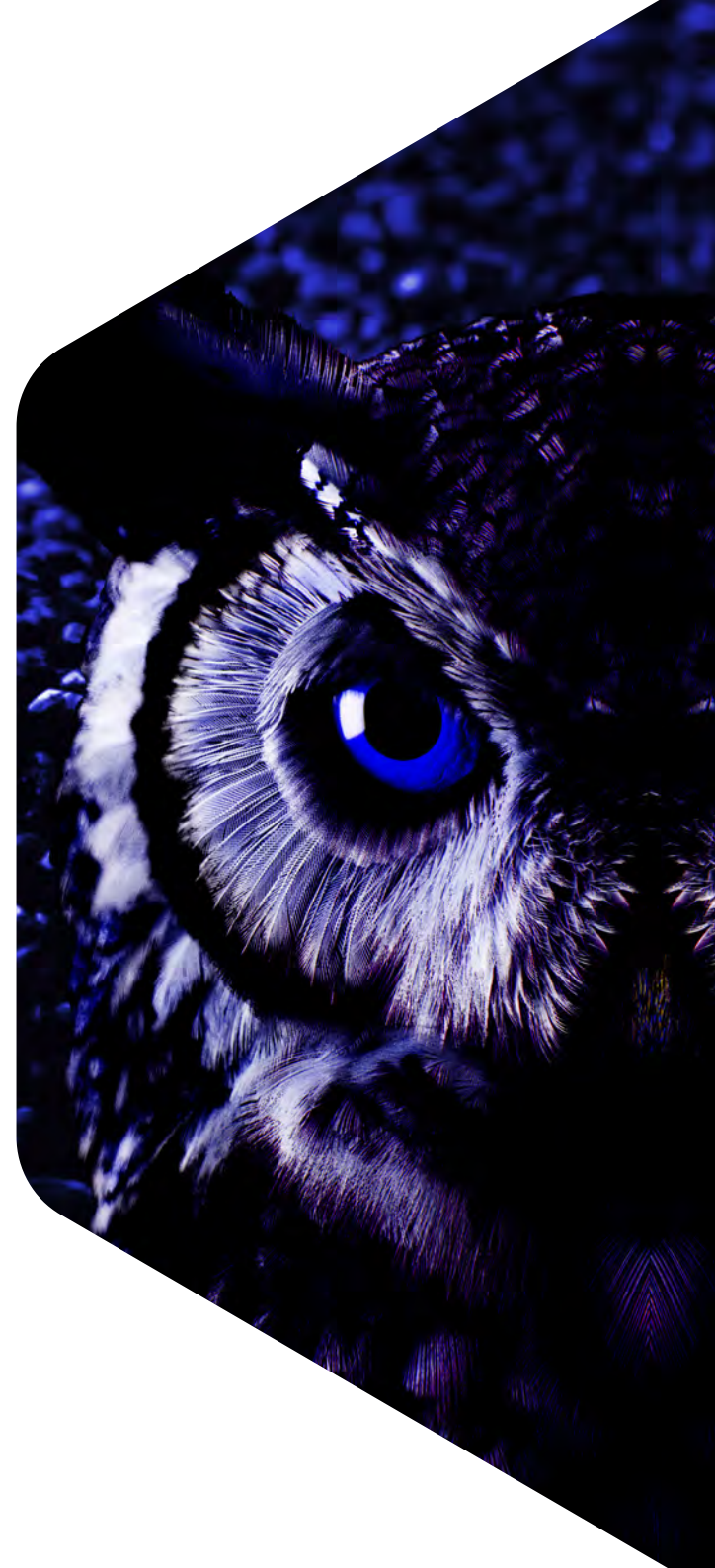
Clarity in **Darkness**

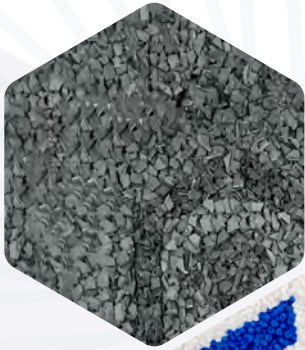
Detect in Carbon Black | Detect Color & Plastic Types | Water Detection in Pellets | Detect the Special among the Equal

Specialists in Contactless Measurement

Sensor Instruments

Sensor Instruments was founded in 1992 as a developer and manufacturer of specialized sensors. Initially, the focus was on a single sector, which has since expanded to a company that delivers innovative sensor solutions in almost every sector. This success has been achieved primarily by adopting a customer-specific approach in the search for solutions. This aligns with Sensor Instruments' motto: "Let's make sensors more individual."





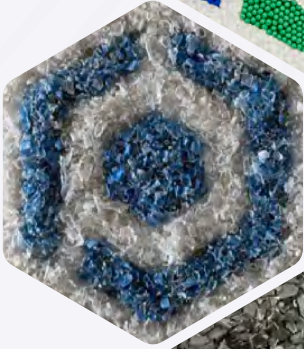
Detect in Carbon Black page 4

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



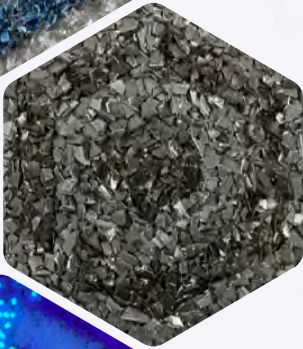
Detect Color in Pellets and Flakes page 6

Maintain control over color consistency and prevent discrepancies



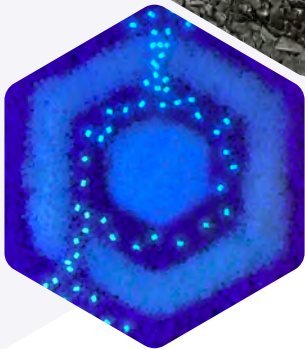
Detect the Plastic Types page 8

NIR differentiation of plastic pellets and flakes



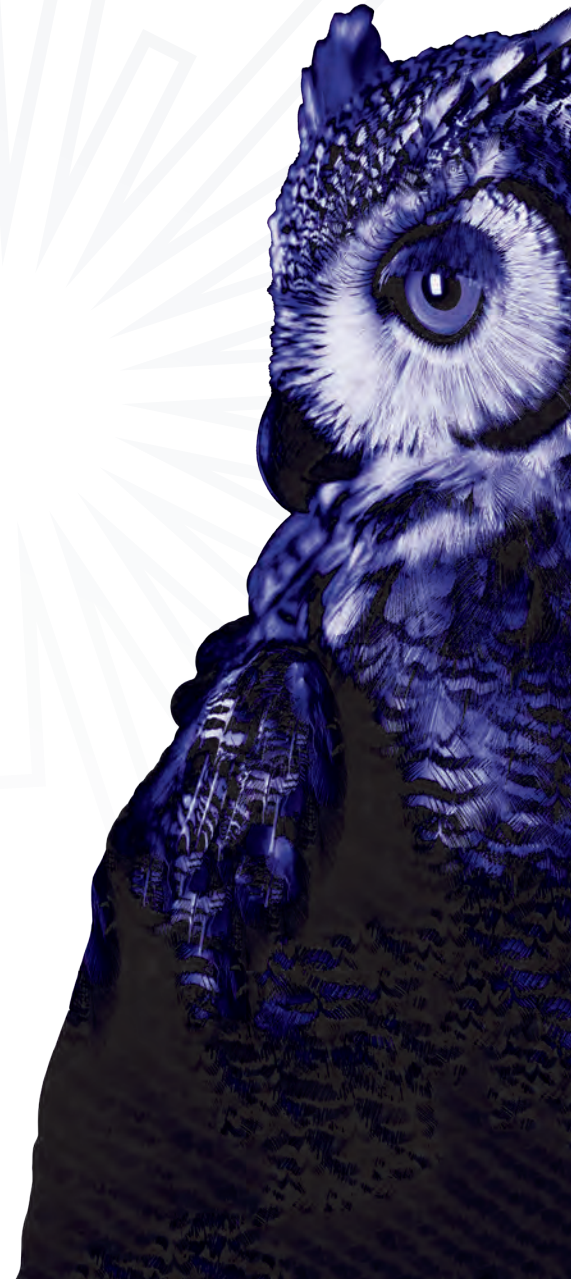
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MIR detection of water content in plastic flakes and pellets



Detect the Special among the Equal page 12

Detecting TAGTEC markers in plastics of the same type





Detect in Carbon Black

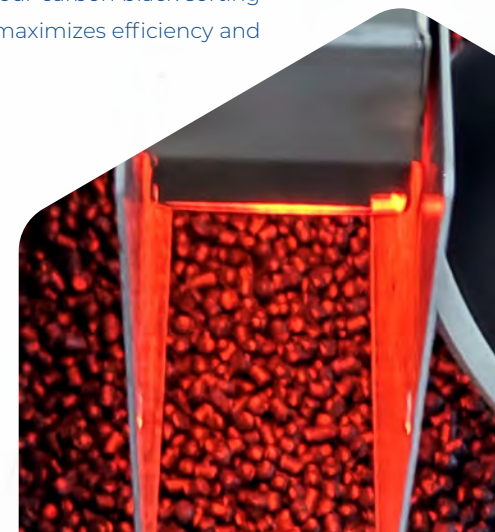
Differentiation of (carbon) black plastic types with analysis from MIR based multi-channel sensors

Vibrational Absorption Spectroscopy is a powerful analytical technique used to investigate molecular vibrations in various materials. Spectroscopy in the mid infrared spectral range (MIR) offers a possibility to identify black polymers. But MIR spectral measurements carried out with Fourier-transform infrared spectrometers (FTIR) are not fast enough, and do not meet economic requirements in sorting plants.

The SPECTRO-M-3 series does not require spectral data or FTIR analysis, it focuses on the MIR range which contain the interesting information. Multi-channel analysis supports fast and economic analysis of material streams and allows precise differentiation of carbon black materials, whether they are parts, pellets, or flakes. A high level of accuracy ensures reliable characterization of carbon black materials, facilitating informed decision-making and quality control.

Clarity in darkness

Empower your production processes with the SPECTRO-M-3 series and streamline your carbon black sorting processes. By automating analysis tasks and providing rapid results, this instrument maximizes efficiency and productivity, allowing you to meet tight deadlines and production targets with ease.



Why invest in MIR multi-channel detection?



Accuracy:

The SPECTRO-M-3's three-range method, large measuring spot, and high scanning frequency swiftly yield high average values, crucial for achieving perfect results.



Quality control:

The system detects even minor foreign plastic contamination before extrusion. This is applicable to both pellets and flakes, with laboratory devices also available.



Versatility:

The measuring system can be used inline to control pellets and flakes, as well as in the laboratory.



Protection:

SPECTRO-M-Multi-Channel technology detects impurities in carbon black plastics, safeguarding extruders, injection molding machines, and product quality.



Data analysis:

The SPECTRO-M-3 measurement system generates 3-dimensional data points providing trends and patterns. This data, analyzed using Artificial Intelligence (AI) methods, helps build quantification models that can be continuously improved through learning.



Monitoring:

Using the monitoring software included in the scope of delivery, deviations from the setpoint and trends are displayed graphically and numerically to the operator on-site in real-time. This enables immediate response and adjustments to ensure optimal performance.



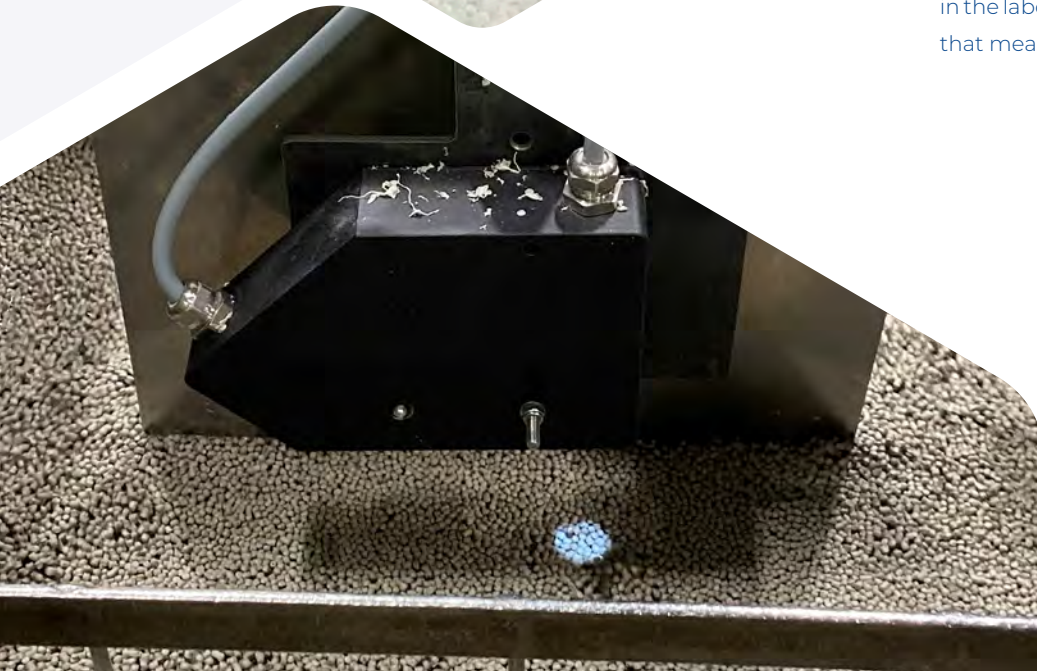
Detect Color in Pellets and Flakes

Maintain control over color consistency and prevent discrepancies

How and where is the best way to measure the color of granules and flakes inline? For inline color measurement of granules and flakes, ideal positions include observing the vibrating channel and looking through a sight glass into the silo. The SPECTRO-3-FIO-MSM sensor, with its optical front end, allows measurements from 85mm above the pellet flow surface, ensuring accurate 45°/0° color readings, perfect for vibrating feeder applications. For silo color measurement, consider the SPECTRO-3-DIF-MSM diffuse/0° sensor or a 45°/0° system with the SPECTRO-3-FIO-MSM and optical front end aimed directly at the material. Both setups use DOCAL Scope V1.5 software to record Lab* values and deviations from the target color space.

Measuring the color of granules and flakes in the laboratory

To ensure that the measurement results from production can be optimally compared with the measurements in the laboratory, the same sensor technology is also used in the laboratory devices, which also has the advantage that measurements can be taken directly on the granulate and flakes in the laboratory.



Why invest in color detection?



Accuracy:

To ensure optimal measurement, the SPECTRO-3 series uses a large light spot diameter, compensating for pellet or flake randomness. Fast three-range method yields high average values swiftly, crucial for perfect results.



Efficiency:

SPECTRO-3's color sensors suit both INLINE and lab measurement, using identical technology for comparable results. Direct measurements on pellets/flakes eliminate the need for sample plates.



Versatility:

Color sensors are suitable for various applications, from silo sight glass checks to measuring freshly produced pellets on a vibrating feeder.



Quality control:

INLINE color measurement ensures 100% control, eliminating random lab checks. It promptly records and displays color deviations with accuracy below dE 0.5.

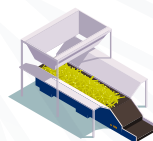


Data analysis:

DOCAL-Scope V1.5 software manages measurement data, displaying values graphically and numerically for trend recognition. Data is accessible via digital serial interface.



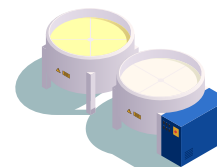
Plastic recycling procedure



Sorting



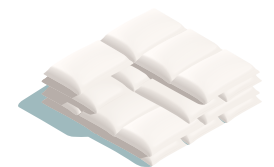
Identification



Cleaning



Remolding



Certification



Detect the Plastic Types

NIR differentiation of plastic pellets and flakes

Impurities in recyclates can cause damage to injection molding machines and extruders, leading to defects in manufactured products. However, this can be avoided through suitable quality control of recyclates and flakes directly in the manufacturing process. A method transferred from color measurement to the NIR range is ideal for this purpose.

The sensor technology used operates according to the three-range method in the NIR range, specifically between 1300nm and 1700nm. In this wavelength range, the vast majority of plastics can be reliably distinguished from each other.

Instead of spectral evaluation, the NIR wavelength range is divided into three sections. Analogous to the three-range evaluation in the visible wavelength range, values are calculated from the raw values of the three NIR wavelength ranges. N^* provides information about the grey value of the material, i^* about the reflection behavior between the medium and the short NIR wavelength range, and r^* indicates the reflection behavior between the medium and the long NIR wavelength range.

Measurements use either the $45^\circ/0^\circ$ or the $diffuse/0^\circ$ method based on the application. The sensor system, separated from granulate or flakes by a sight glass, integrates seamlessly into silos or dosing systems, suppressing direct reflection. Less data processing, compared to spectral analysis, enables averaging numerous individual measurements for increased accuracy, aided by a 20mm measuring spot. Laboratory devices with identical methods facilitate precise comparison of laboratory and inline measurement values.



Why invest in NIR detection?



Accuracy:

The NIR system's combination of the three-range method, large measuring spot, and high scanning frequency achieves a measurement accuracy of Δ NIR less than 0.5 units, compensating for pellet variations effectively.



Quality control:

The compact system detects even minor foreign plastic contamination inline before extrusion, applicable to both pellets and flakes, with laboratory devices also available.



Versatility:

The measuring system can be used inline and in the laboratory to control pellets as well as flakes. With the aid of a sight glass, the sensors can be easily attached to silos and dosing units.



Protection:

NIR technology detects plastic impurities, safeguarding extruders, injection molding machines, and product quality.



Data analysis:

The NIR measurement system generates detailed data that can be analyzed for trends and patterns. This data can provide valuable insights into the manufacturing process and help identify areas for improvement.



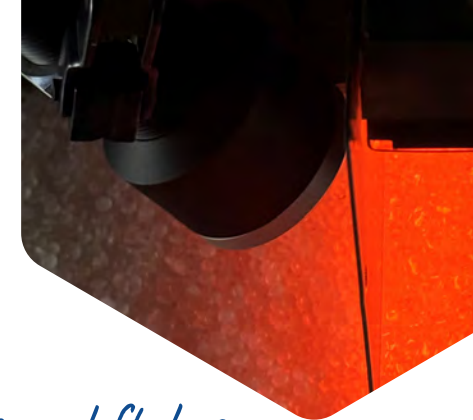
Monitoring:

Using the monitoring software included in the scope of delivery, deviations from the setpoint and trends are displayed graphically and numerically to the operator on-site in real-time.





Detect Water in Pellets and Flakes

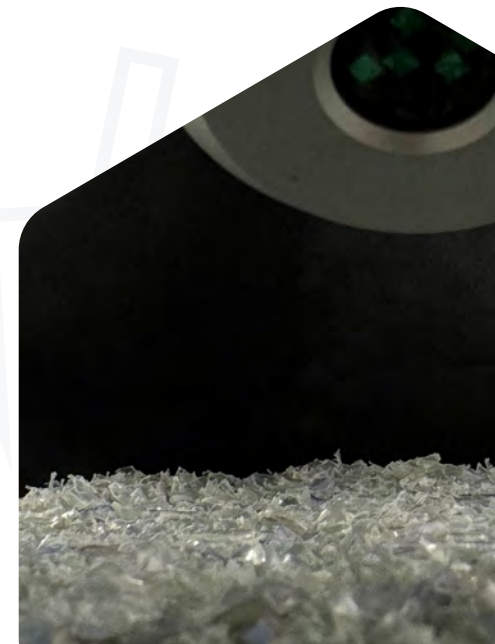


MIR detection of water content in plastic pellets and flakes

Vibrational Absorption Spectroscopy is a powerful analytical technique used to investigate molecular vibrations in various materials. In the MIR, absorption is caused by the fundamental vibrations of the illuminated materials. Water has a fundamental absorption wavelength of $2.95\mu\text{m}$. The water absorption is much more pronounced in the MIR range than in the NIR range. MIR detection is therefore particularly suitable for detecting and quantifying water in samples.

Detect smallest water content with the SPECTRO-M-2-2.95/3.9

The SPECTRO-M-2-2.95/3.9 has been designed to detect even smallest proportions of water in plastic flakes and pellets. Empower your extrusion processes by measuring the water content and optimize your extrusion parameters. By automating analysis tasks and providing rapid results, this instrument maximizes efficiency and productivity, allowing you to meet tight deadlines and production targets with ease.



Why invest in MIR water detection in pellets and flakes?



Accuracy:

The water absorption in the MIR range is much more pronounced than in the NIR range. MIR detection is therefore particularly suitable for detecting and quantifying water content in any samples.



Efficiency:

SPECTRO-M-2-2.95/3.9 sensors suit both INLINE and lab measurement, using identical technology for comparable results. Direct measurements on pellets and flakes.



Versatility:

The MIR sensor system can measure the water content in plastic flakes and pellets inline. It is also suitable for measuring water content in a laboratory setup or at-line, delivering accurate results in a short time.



Quality control:

INLINE water measurement ensures 100% control, eliminating the need for random lab checks. It promptly records and displays water content deviations, with high resolution.



Protection:

An uncontrolled water content in flakes and pellets can lead to increased wear on extruders and injection molding machines as well as injection molding tools.



Optimization:

A controlled material supply with regard to the water content optimizes the quality of the plastic products.



Detect the Special among the Equal

Detecting TAGTEC markers in plastics of the same type

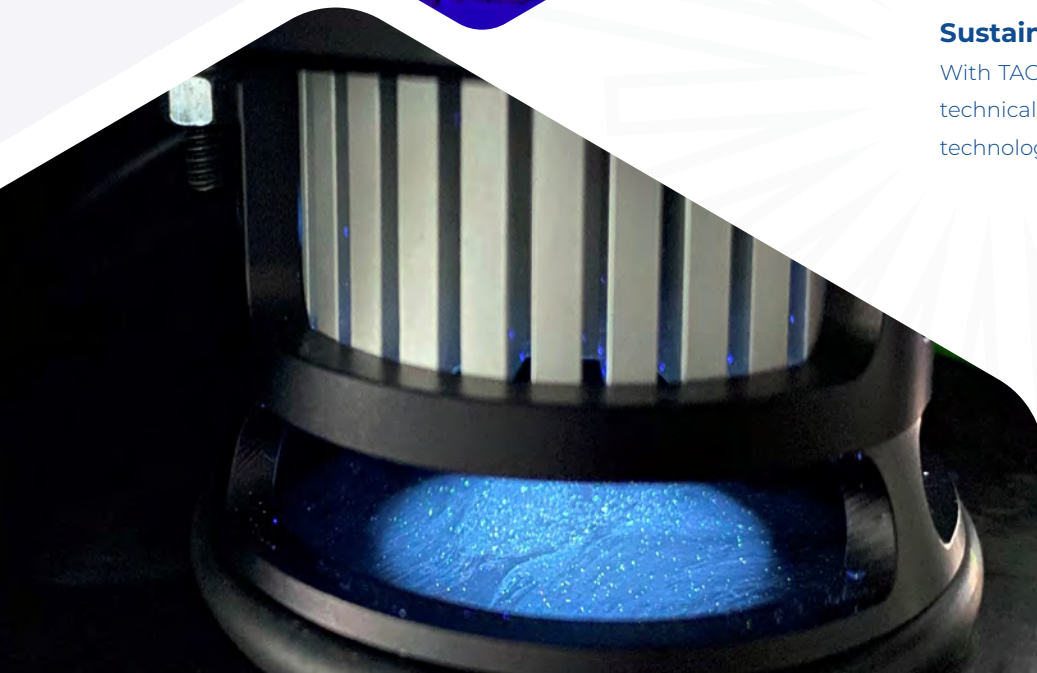
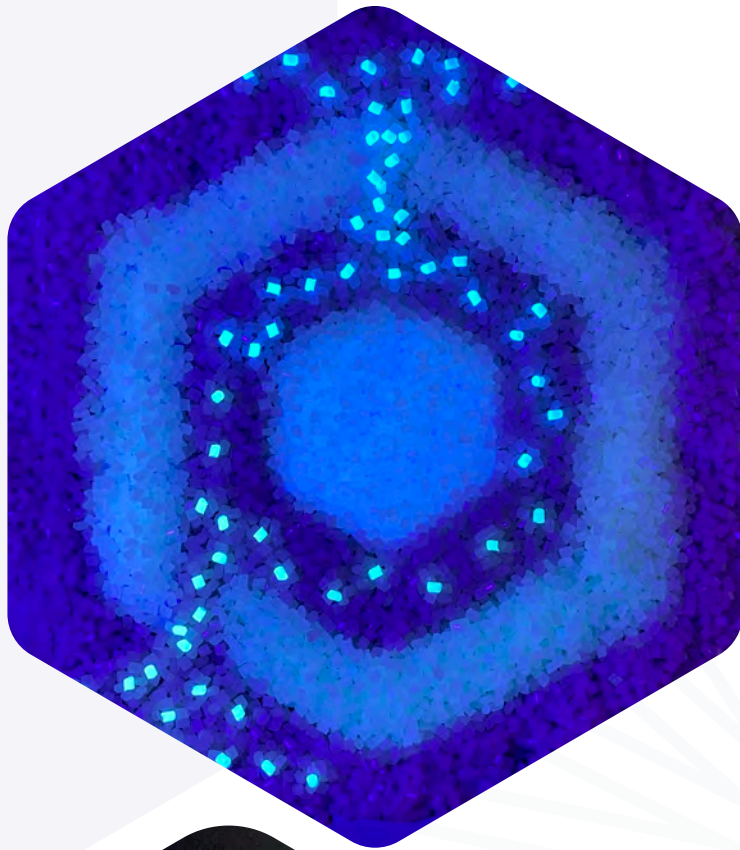
TAGTEC markers revolutionize the way we verify product authenticity and trace materials within plastics of the same type. In an era where counterfeit products pose significant challenges to businesses and consumers alike, TAGTEC-Markers not only offer a robust solution to safeguard your brand reputation and ensure consumer trust, they make it possible to identify your special plastic component in a stream of the same material.

Why TAGTEC markers?

TAGTEC markers are cutting-edge inorganic markers embedded within plastics during the manufacturing process. These markers are uniquely encoded and virtually impossible to replicate, making them an ideal solution for anti-counterfeiting measures and traceability.

Sustainability for optimum recycling of materials

With TAGTEC, it is possible to bring packaging from any recycling waste management scheme into a closed technical production cycle - an active contribution to resource and climate protection. In addition, the technology enables the analysis of material components, such as controlling approved ingredients.



Product authentication and identification with the TAGTEC marker-based system offers these application possibilities:



Differentiation of recycled material:

The use of different TAGTEC markers, which do not influence each other due to their individual excitation wavelength, makes it easy to differentiate between the marked products and thus separate them. Furthermore, the respective proportion of differently marked pellets can also be determined in the recycle.



Material control and identification:

With the rise in recycle usage, knowing the plastic's history is crucial, especially regarding contact with food or toxins. Traditional NIR detection fails to reveal this continuity in plastic matrices. Although systems exist for detecting digital watermarks on packaging, their effectiveness diminishes after shredding or extrusion.

The TAGTEC marker remains easily detectable in recycled material. Equipped with a suitable dosing unit, it accurately measures existing markers and ensures limits aren't surpassed by adjusting TAGTEC masterbatch and virgin material accordingly.



Optimization, documentation, and automation of product processes R-Cycle:

R-Cycle is the open traceability standard for sustainable plastic products and packaging. With the digital product passport, recycling-relevant information is already automatically recorded during packaging production and filling, forwarded through a value chain, and made retrievable via appropriate marking. This enables waste sorting plants to identify recyclable packaging and form recycling-friendly, single-variety fractions. This is the basis for obtaining high-quality recyclates and a functioning circular economy.



TAGTEC recycling applications

- ✓ Additional sorting criteria by application, product group
- ✓ Differentiation between FOOD material and NON-FOOD material during recycling
- ✓ Further freely definable recycling sorting options
- ✓ Recovery of valuable ingredients with defined properties and additives



 **R-Cycle**  **TAGTEC**



Our specialists are happy to tell you more about it

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