

Application Note

# MicroNIR Onsite-W for Plastic Recycling Identification

Near Infrared Spectroscopy (NIR) is a powerful tool to identify polymers, both in production and during recycling

Recycling of plastic materials involves the collection and reprocessing of discarded or waste plastics into new, usable products. Given that most plastics are not biodegradable, recycling initiatives aim to mitigate the environmental impact of plastic waste—particularly the estimated 8 million metric tons that enter our oceans annually. Unlike metals, which can be recycled profitably, plastic recycling faces unique challenges due to the material's bulkiness and lower value. Additionally, technical complexities arise in recycling facilities tasked with sorting and processing plastics. The MicroNIR Onsite-W offers a robust, handheld solution that enables even novice operators to rapidly identify various types of plastics in under a second.

When different types of plastics are melted together, they tend to phase-separate, like oil and water. The phase boundaries cause structural weakness in the resulting material, meaning that polymer blends are useful in only limited applications. The two most widely manufactured plastics, polypropylene, and polyethylene, behave in this way, which limits their utility for recycling. Each time plastic is recycled, additional virgin material must be added to help improve the integrity of the finished product. So, even recycled plastic has new plastic material added in. The same piece of plastic can only be recycled about 2–3 times before its quality decreases to the point where it can no longer be used.



Figure 1 - MicroNIR Onsite-W wireless spectrometer

The MicroNIR® Onsite-W is VIAVI Solutions innovative, ultra-compact spectrometer. With integrated battery, button, and Bluetooth wireless communication, the Onsite-W is the ideal solution for mobile material analysis in the factory or in the field. The MicroNIR Onsite-W is the smallest fully integrated NIR spectrometer on the market and is enabled by solid state VIAVI linear variable filter (LVF) technology. With no moving parts or optical fiber and IP65/IP67 dust/water ingress ratings, it is designed for a wide range of material characterization applications. The Onsite-W is available with our new VIAVILab mobile solution for remote sample identification using an iOS or Android mobile phone. The VIAVILab™ Suite includes three components:

- Mobile app
- Web app
- Web based chemometric modeling package

The mobile app has a simple, intuitive interface that provides real-time scanning and identification of plastic samples.

The VIAVILab Mobile App connects wirelessly to the Onsite-W to offer sample identification in one second with a single button press. Results are displayed on the connected mobile phone screen.

The sample name can be entered manually or using a bar code reader. A photo and geolocation ID can be attached to the scan and synced with the VIAVILab web app. All access is protected by a UserID and Password.

The Web app can also manage the MicroNIR Onsite-W fleet. Users can be assigned to specific methods and instruments and tracked remotely.

All results collected via the mobile app can be uploaded to a secure cloud database and viewed by instrument serial number, operator or date (Figure 3).

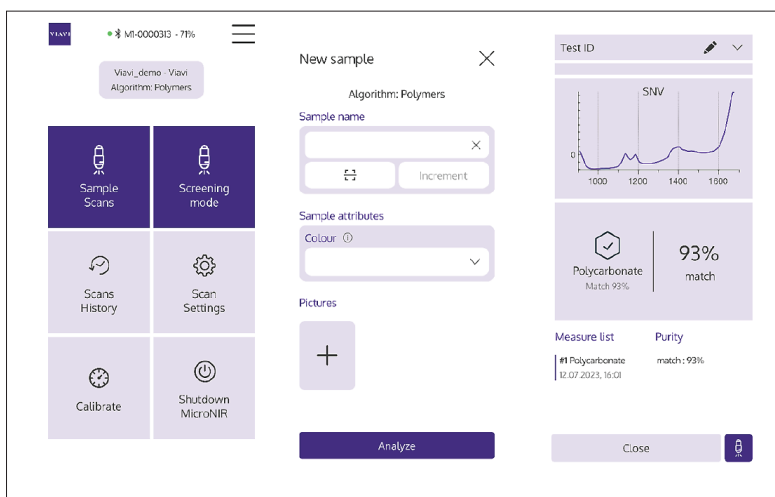


Figure 2 – VIAVILab mobile app screen, showing the results of a single scan.

## Benefits

- Rapid, real-time, non-destructive near-infrared material analysis
- Wireless, compact, rugged, and ergonomic design for one-hand operation
- Multifunction button for one-click data acquisition
- Internal, rechargeable Li battery with run time greater than 10 hours
- IP65 and IP67 rated for use in wet and dusty environments
- Compatible with MicroNIR sampling accessories
- VIAVILab Suite with Mobile App and Web App for iOS and Android

Date	Name	Substance	KNN	Added by
25/07/23 10:38	20230725_133750	PE Isomer	Match 99% match 99%	Ekoosea Mustang (Vavi)
24/07/23 13:15	20230724_181450	PP PP-Calcium-Car... PP-Glass-Filled	Match 99% match 99% match 99%	Ekoosea Mustang (Vavi)
19/07/23 11:25	20230719_12454	PE Isomer	Match 98% match 99%	Ekoosea Mustang (Vavi)
19/07/23 10:52	20230719_115203	PE	Match 99%	Ekoosea Mustang (Vavi)
06/07/23 12:25	20230706_132315	PP PP-Copolymer	Match 99% match 94%	Ekoosea Mustang (Vavi)
03/07/23 10:10	20230703_101658	Polycarbonate	match 93%	Ekoosea Mustang (Vavi)
03/07/23 10:18	20230703_101841	Polycarbonate	match 94%	Ekoosea Mustang (Vavi)
02/07/23 11:04	20230702_190451	Unknown substance	-	Ekoosea Mustang (Vavi)

Figure 3 – VIAVILab web app screen showing multiple ID results created by a user

## NIR identification of plastics

NIR reflectance spectroscopy can distinguish plastic packaging and plastic waste by polymer type. NIR uses the chemical signature of polymer resins such as polyethylene, polypropylene, polystyrene, PET, PVC, Nylon (polyamide) and many others to distinguish and sort them from one another.

VIAVI Solutions has developed an identification library algorithm to identify 50 different plastic types (Table 1), including the “big five”, PE (HD and LD), PP, PS, PET and PVC. Colored, opaque, and transparent samples can be identified, as shown in Figure 5.



Figure 4 - Example of plastic waste



Figure 5 - Example of cataloging for PET color samples

Table 1 – Polymer Identification List

Polymer name	Result
ABS	OK
ABS-Flame-Retardant	OK
ABS-HI	OK
ABS-MI	OK
ABS-Nylon-Alloy	OK
ABS-Transparent	OK
Acetal-Resin-Copolymer	OK
Acetal-Resin-Homopolymer	OK
Acrylic	OK
ASA	OK
Cellulose-Acetate	OK
Cellulose-Acetate-Butyrate	OK
Cellulose-Acetate-Propionate	OK
EVA	OK
Ionomer	OK
Mica-Reinforced-Polypropylene	OK
Modified-Acrylic	OK
Nylon-Polyamide-Type-66	OK
Nylon-Transparent	OK
Nylon-Type-66-33%-Glass	OK
PBT	OK
Polyallomer	OK
Polybutadiene	OK
Polycarbonate	OK
Polyester-Elastomer	OK
Polyethylene-HD	OK
Polyethylene-LD	OK
Polyethylene-MD	OK
Polymethylpentene	OK
Polyphenylene-Oxide	OK
Polyphenylene-Sulfide	OK
Polystyrene-GP	OK
Polystyrene-HI	OK
Polystyrene-MI	OK

Polymer name	Result
Polysulfone	OK
PP-Barium-Sulfate	OK
PP-Calcium-Carbonate-Reinforced	OK
PP-Copolymer	OK
PP-CopolymerPolyethylene-HD	OK
PP-Flame-Retardant	OK
PP-Glass-Filled	OK
PP-Homopolymer	OK
PVC-Flexible	OK
PVC-Rigid	OK
PVDF	OK
SAN	OK
Styrene-Butadine-Block-Copolymer	OK
Styrenic-Terpolymer	OK
Synthetic-Elastomer	OK
Talc-Reinforce-PP	OK
Thermoplastic-Polyester-PBT	OK
Thermoplastic-Polyester-PETG	OK
Thermoplastic-Rubber-TPV	OK
Urethane-Elastomer-Thermoplastic	OK
HDPE	OK
LDPE	OK
PA12	OK
PA6	OK
PA66	OK
PE	OK
PET	OK
PMMA	OK
PP	OK
PS	OK
PTT	OK
PVC	OK