

## Plastic Identification

Supported by:



Federal Ministry  
for the Environment, Nature Conservation,  
Nuclear Safety and Consumer Protection



based on a decision of  
the German Bundestag

# Target Materials: Plastics groups and types

	Thermoplastics	Elastomers	Duroplasts	Thermoplastic Elastomers
<b>Plastic types</b>	PE, PE-LD, PE-HD, PP, PET, PVC, PTFE, PS, PMMA, POM, PA, PC, PPS, PI, ABS	Synthetic rubber, silicones	PF, UF, MF, UP, EP, PUR	TPE
<b>Properties</b>	Softenable, meltable between 130...260°C (as often as required), swellable in organ. Soluble, medium tensile strength and stiffness, embrittlement at low temperatures	Not meltable or soluble, swellable in organic solvents. Heating (to approx. 200°C) and mechanical stress leads to a certain partial destruction of the cross-linking, low stiffness and tensile strength.	Not meltable or soluble, not swellable in organic solvents, High stiffness and tensile strength, brittle and more heat resistant (up to 180°C)	Thermoplastic elastomers are plastics that behave similarly to classic elastomers at room temperature, but can be plastically deformed when heat is applied and thus exhibit thermoplastic behaviour.
<b>Range of applications</b>	Packaging, films, tubes, hoses, housings, beverage bottles,	Tyres, tubes, rubber springs, cable sheaths,	Sockets, insulating plates, brake pads, screw caps, household appliances, tableware, adhesives, upholstery, casting resins	Seals, hoses, membranes, shoe soles
<b>Form of recycling</b>	Mechanical recycling, chemical recycling, energy recovery	Energy recovery	Energy recovery	Energy recovery

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# Challenges of mechanical recycling

- **Deterioration of mechanical and optical properties during life cycle and recycling process through:**
  - Exposure to atmospheric oxygen and UV radiation
  - Mechanical stress
  - Metallic impurities
- **Limited compatibility of the plastic types with each other**
  - Large variety of plastic types, reinforcing materials, dyes, additives, compound materials (e.g. multilayers)
  - Large variety of products and shapes (hollow bodies, foils)
  - Different impurities and residuals
- **Limited possibilities for material purification**

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# Target Materials: Thermoplastics

POLYETHYLENE TEREPHTHALATE	HIGH-DENSITY POLYETHYLENE	POLYVINYL CHLORIDE	LOW-DENSITY POLYETHYLENE	POLYPROPYLENE	POLYSTYRENE	All other plastics, including acrylic, fiberglass, nylon, polycarbonate, and polylactic acid (a bioplastic)
						
PET or PETE	HDPE	PVC	LDPE	PP	PS	OTHER
Commonly Recycled	Commonly Recycled	Sometimes Recycled	Sometimes Recycled	Occasionally Recycled	Commonly Recycled (but difficult to do)	Difficult to Recycle

Source: The 7 Types of Plastics: Their Toxicity and What They are Most Commonly Used For (alansfactoryoutlet.com)



soda bottles, water bottles, polyester film, containers for food, jars, fibers for clothing



detergent containers, plastic bottles, piping for water and sewer, snowboards, boats



window frames, plumbing products, electrical cable insulation, clothing, medical tubing



shopping bags, plastic bags, clear food containers, disposable packaging



laboratory equipment, automotive parts, medical devices, food containers



CD and DVD cases, packing peanuts, single-use disposable cutlery, trays



baby feeding bottles, car parts, water cooler bottles, sippy cups

Source: Adobe Stock

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# Variety of Plastic types



Plastic bags

Hard Plastics

PET bottles

Plastic foils

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# Target Material: Identification tests

	Test
1.	<b>Look at the sample:</b> <ul style="list-style-type: none"><li>• Is it transparent, translucent or opaque?</li></ul>
2.	<b>Feel the sample:</b> <ul style="list-style-type: none"><li>• What does the surface feel like?</li><li>• Does it bend?</li><li>• Can it be scratched?</li></ul>
3.	<b>Cut the sample with a sharp knife:</b> <ul style="list-style-type: none"><li>• Does it cut easily?</li><li>• Are the edges smooth or jagged?</li></ul>
4.	<b>Float test:</b> <ul style="list-style-type: none"><li>• Does it float or sink? (Water should be around room temperature).</li></ul>
5.	<b>Burn test:</b> Try to burn a small piece of the sample. <ul style="list-style-type: none"><li>• What is the size and colour of the flame?</li><li>• Do molten drips fall from the sample and continue to burn?</li><li>• Does the sample self-extinguish?</li><li>• Is there any odour when the flame has been extinguished?</li></ul>

***Identification is not easy!***

***It is recommended, to perform all tests to be certain.***

***Also samples should be send to oftaker to make sure material meets their requirements!***

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# Target Material: Identification tests

## Looking and feeling



## Cutting

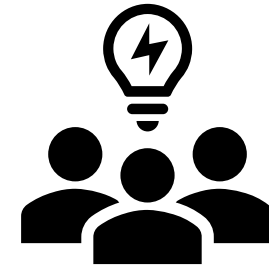


## Sink/Float test



HDPE  
LDPE  
PP  
  
PET

## Burn test



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# Target Material: Identification of PET



Test	Observation
1	Transparent only as thin film, translucent in thicker sections
2	Fairly flexible and deformable
3	Easily and smoothly cut
4	<b>Sinks</b>
5	<ul style="list-style-type: none"><li>• Drips when exposed to flame; Produces a <b>burnt sugar smell</b> when exposed to flame; <b>Yellow flame</b> and light smoke</li><li>• Burns slowly</li></ul>

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# Target Material: Identification of HDPE



Test	Observation
1	Transparent only as thin film, translucent in thicker sections
2	Fairly stiff and hard, can be scratched by fingernail
3	Easily cut with smooth edges
4	<b>Floats</b>
5	<ul style="list-style-type: none"><li>• Not self-extinguishing; molten droplets which usually go out on reaching bench or floor;</li><li>• <b>blue flame with yellow tip</b> and little smoke, smell of burning candle/paraffin when the flame is extinguished</li></ul>



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# Target Material: Identification of LDPE



Test	Observation
1	Transparent only as thin film, translucent in thicker sections
2	Fairly flexible; soft, 'waxy' feel, easily scratched
3	Easily and smoothly cut
4	<b>Floats</b>
5	<ul style="list-style-type: none"><li>• Not self-extinguishing; molten droplets which usually go out on reaching bench or floor;</li><li>• <b>blue flame with yellow tip</b> and little smoke, <b>smell of burning candle/paraffin</b> when flame is extinguished</li></ul>



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# Target Material: Identification of PP



Test	Observation
1	Transparent only as thin film, translucent in thicker sections
2	Stiff; hard, can be scratched by fingernail
3	Harder to cut, larger pieces often crack, sharp edges, leaves white mark
4	<b>Floats</b>
5	<ul style="list-style-type: none"><li>• Not self-extinguishing; molten droplets which usually go out on reaching bench or floor;</li><li>• flame mainly yellow with a trace of clear blue at the bottom; <b>smell of diesel</b> when flame is extinguished.</li></ul>



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# About Us

**Rodiek & Co GmbH** is a consulting company in the field of waste management, recycling and circular solutions.

It is our Mission to support the development of a functioning circular economy by providing experience and operational knowhow.

Our target regions are low- and middle- income countries, where waste management and recycling is still in its early stages.

Our solutions are tailored to the specific local requirements and needs.

We provide services along the complete value chain from collection over sorting, to treatment and preparation for recycling.

We provide technical support for facilities, including vehicles, machinery as well as material flow management.

We also offer the development of sustainable recycling and energy concepts for local communities, businesses and industries.

As a 100% daughter company of Nehlsen Group, one of the largest German waste management and recycling companies, we can access the operational knowhow and practical expertise from 99 years of waste management and recycling business in Germany.

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