

Evaluation of Marker Materials and Spectroscopic Methods for Tracer-Based Sorting of Plastic Wastes

Supplementary Material S1

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Table S1. Terms used for the research on possible tracer substances/compounds in the search engines, divided into three categories: unspecific, substance specific, method specific.

Search terms		
Unspecific	Substance specific	Method specific
Tracer based sorting	Perylene tetraesters	XRF
Marker	Perylene diimides	NIR
Advanced materials	Quinacridone	UV-VIS
Excitation	Polyoxy-methylene (POM)	IR
Emission	Organic	LIBS
Luminescence	Inorganic	FTIR
Materials	Single walled carbon nano tubes	RAMAN
Nanocrystals	Quantum dots	Up-conversion fluorescence spectroscopy

Table S2. Compatibility of POM with other polymers. This information is taken from VDI 2343 Blatt 5 - Recycling of electrical and electronic equipment - Material and thermal recycling and removal. M... mixable, I...immiscible, B...bonding agent required.

	ABS	ASA	PA	PBT	SB	PC	PE-LD	PE-HD	PES	PET	PMMA	POM	PP-H	PP-HI	PS	PVC	SAN
ABS	-	M	B	I	I	M	I	I	I	I	M	I	I	I	I	M	M
ASA	M	-	B	I	I	M	I	I	I	I	M	I	I	I	I	M	M
PA	B	B	-	I	B	B	B	B	I	I	I	I	B	B	B	I	B
PBT	I	I	I	-	I	M	B	B	I	M	I	I	B	B	I	I	I
SB	I	I	B	I	-	I	B	B	I	I	I	I	B	B	M	I	I
PC	M	M	B	M	I	-	I	I	M	M	M	I	I	I	I	I	M
PE-LD	I	I	B	B	B	I	-	M	I	B	I	I	I	M	B	I	I
PE-HD	I	I	B	B	B	I	M	-	I	B	I	I	I	M	B	I	I
PES	I	I	I	I	I	M	I	I	-	I	I	I	I	I	I	I	I
PET	I	I	I	M	I	M	B	B	I	-	I	I	B	B	I	I	I
PMMA	M	M	I	I	I	M	I	I	I	I	-	I	I	I	I	M	M
POM	I	I	I	I	I	I	I	I	I	I	I	-	I	I	I	I	I
PP-H	I	I	B	B	B	I	I	I	I	B	I	I	-	M	B	I	I
PP-HI	I	I	B	B	B	I	M	M	I	B	I	I	M	-	B	B	B
PS	I	I	B	I	M	I	B	B	I	I	I	I	B	B	-	I	I
PVC	M	M	I	I	I	I	I	I	I	I	M	I	I	I	I	-	M
SAN	M	M	B	I	I	M	I	I	I	I	M	I	I	I	I	M	-

Table S3. Examples of applications for POM polymers.

Application	Components	Desired characteristics
Electrical and Electronic Equipment	Gear wheels, mechanical reinforces, clips, and other precision (durable) parts in printers, telephones, radio, television, washing machines, refrigerators and electric shavers	High mechanical stress resilience combined with high precision production and moulding
Automotive	Seat belt adjuster, speaker grille, door lock, automotive clips, air filtration system, fuel caps, fuel pump modules	High durability, low-gloss surface and other specific aesthetic characteristics, resistance to cleaning solutions and dimensional stability
Furniture	Fittings, locks, handles, hinges, curtain and door rollers, chairs, desk surfaces	High durability and mechanical stress resilience, resistance to cleaning solutions and water
Construction and buildings	Sleeves for point supports, valve components, door and window frames	Excellent combination of hardness, rigidity, and toughness, broad temperature range, water resistance
Household utensils and textiles	Spice mills, grinders, zip fasteners, clothing clips, vapour and e-cigarette accessories, knife handles, coffee brewers	High mechanical stress resilience combined with high precision production and moulding