## **Plastics Identification Table**

By Dr. Hansjürgen Saechtling

## **Physical Properties**

## Pyrolysis, Solubility and Individual Identification Tests

Plastic Materials (arranged in chemical groups)	nemical			al				Usual Appea		)	Ela Bel	istic havior		Sample slowly heated in pyrolysis tube			on with small	Odor of gases given off on heating in pyrolysis tube or after ignition		ubility	in Co	ld Sol	vents	<b>3</b>			Characteristic element, individual identification tests (Compare Chapter 4 "Testing for Heteroatoms", and Chapter 6 "Specific Identification Tests")
				unfilled filled up to			ts				m = melts d = decomposes	es given off	I = be	= hardly ingnitable urns in flame, guishes in	and extinction	s = soluble sw = swellable i = insoluble								1656)			
	Number Standard Abbreviation (ISO 1043/ ASTM 1600)		g/ cm³	g/ cm³		transparent, clear	nazy to opaque	y or rubk	flexible, resilient	hard	al = alkaline n = neutral ac = acidic sac = strongly cidic	Reaction of gases	after ignition			Gasoline	Benzene	Methylene chloride	Diethyl ether	Acetone	Ethyl acetate	Ethyl alcohol	Water	א א מוכז			
4 Polyalatina																								Different melting ranges:			
1. Polyolefins	PE	Polyethylene soft (chlorinated PE to	> 0.92						+		becomes clear,			yellow with blue	slight paraffin-	i sw	sw	i sw	i sw	i sw	i sw	i	i	105-120 °C			
		(chlorinated PE to see group 3) hard	< 0.96		+	-	+		+	+	m, d, vapors are barcly visible	n	"	center, burning droplets fall off	like odor	i	i sw	i sw	i	i	i	i	i	125-130 °C			
1.2	PP	Polypropylene	0.905	1.3*	+		+			+						i sw	i	i sw	i	i	i	i	i	165-170 °C			
1.3 1.4	PB PIB	Polybutene-1 Polyisobutylene	0.915 (0.93)	1.7	,	-		+			m, vaporizes, gases can be ignited	n	II	yellow, burns quietly	paraffin- and rubber-like	sw s	i s	i s	i sw	i i	i i	i i	i i	130-140 °C			
1.5	PMP	Poly-4-methylpentene-1	0.83			+				+		n	II	yellow with blue center, drips		sw	sw	i	i	i	sw	i	i	245 °C			
2. Styrene Polymers																											
		Polarium of (num)	1.05		+	+				+	m and evaporates	n	II		characteristic of city gas	sw s	S	S	S	S	s	i	i	On breaking by hand: brittle fracture			
2.1 2.2	PS SB	Polystyrene (pure) High impact polystyrene (with	1.05				+		+	+	m, yellowish, d	n	П		like PS + rubber	sw s	S	s	S	s	s	i	i	white fractur			
2.3	SAN	polybutadiene) Styrene-acrylonitrile copolymer	1.8	1.4*	+	+				+	m, yellow, d	al	II	flickers, yellow, bright very	similar toPS, irritating	i	S	S	S	S	s	i	i	N, brittle fracture			
														sooty		Rate	Rate of dissolution depends on type of copolymer										
2.4	ABS	Acrylonitrile/ butadiene/ styrene copolymer	1.06			-	+		+	+	d, turns black	n (ac)	II		like PS + cinnamon	SW S	S	s	S	S	S	sw	i				
2.5	ASA	Acrylonitrile/ styrene/ acrylate copolymer	1.07				+			+	m, d, black residue	ac	II		like PS + pepper	sw s	s	S	sw	s	s	sw	i	N, white fracture			
3. Haolgen-containing Homopolyn 3.1	ners PVC	Polyvinylchloride, 55 % Cl Copolymer with VAC (or similar)	1.39 1.35		+	+				+		sac	1			і	i sw olyme	sw i r sw/	i s s eas	i s ier th	i sw an P\	i /C	i				

3.2	PVCC	High temp.resistant, 60-67 % CI	~ 1.5		+ (-	+)			+ softens, d becomes brown- black	sac	I	yellow, sooty, lower edge of flame is slightly green	hydrochloric acid (HCI) and also a burnt odor	i	i sw	i	i	i i sw	i	i	CI, differentiate materials according to CI-content and softening temp.
3.3	PVC- HI	EVAC (or similar)	1.2 - 1.35		+	+	+			sac ac	I/ II			i sw	i sw	sw s	i sw	sw i		i	
0.0.4	DEG	made elastic with chlorinated PE	1.3 - 1.35		+	+		+	+	sac	1			i		sw	. i ]	i i	į	i	
3.3.1	PEC	Chlorinated PE (pure homopolymer)	1.1 - 1.3			+	+	+	m, becomes brown	sac	I/ II	yellow, bright, sooty	HCl + paraffin	sw	conte		: and I	PVC depe	naing c	on CI-	
3.4	PVC- P	Plasticized (properties depending on plasticizer)	1.2 - 1.35	1.6	+	+ +	+		similar to PVC	sac	I/ II	bright (due to plasticizer)	HCl + plasticizer	i	sw	SW	sw	sw sw	sw	/ i	stiffens on extracting the plasticizer
3.5	PTFE PFEP PFA ETFE	Polyetrafluoroethylene PTFE-like molding materials	2.0 - 2.3 1.7			+		+	becomes clear, doesn't melt, d at red heat	sac	0	doesn't burn, blue-green edge on flame, doesn't char	at red heat stinging odor: HF	i PFA	i	i Esw	i	noved by [ i i : CCI	Diethyl i	ether i	F PFEP, PFA melt at 360°C ETFE melts at 270°C
3.6	CTFE	Polytrifluorochloroethylene	2.1			+ +		+		sac	0	like PTFE, sparks	HCI + HF	i	i	i	i	i i	i	i	F, Cl
3.7	PVF <sub>2</sub>	Polyvinylidene fluoride	1.7 - 1.8		+ (-	+) +			+ m, d at high temp.	sac	0/ I	hardly inflammable	stinging (HF)	i	i	SW	i sw	sw i	i	i	F
4.B. 1. 1. 4. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	514	1)																			
<b>4. Polyvinylacetate and Derivatives</b> 4.1	PVAC	Polyvinyl acetate	1.18		Dispe	rsions	+	+	m, brown,	ac	II	bright, sooty	acetic acid and	i	s	s	sw	s s	s	i	
4.1.1	PVAL	Polyvinyl alcohol	1.2 - 1.3		+	1	+	+	evaporates m, d, brown	n	I/ II	bright	additional odor irritating					i i		s 1	<sup>1</sup> ) in cold and
4.1.2	PVB	Polyvinyl butyral	1.1 - 1.2		safety	glass s	heet +		residue m, d, foams	ac	II	blue with	rancid butter	boilii i		sw		cetyl grou	s		
4.2		Polyacrylates	1.1 - 1.2		Dis	spersion	ns +	+	m, d, evaporates	n	П	yellow edge bright,	typically sharp	i		S S			s	i ¹	
4.3	PMMA	Polymethyl methacrylate	1.18			+			+ softens, d, swells up and crackles, little residue	n	II	slightly sooty burns with crackling, drips, bright	typically fruity	s i	S	yacry s	i	s s	i	i	cast acrylic sheed hardly softens
4.4	AMMA	Methyl methacrylate/ acrylonitrile copolymer	1.17		yel	+ llow			+ brown, then m, d, black	al	II	sooty, sparks slightly	first sharp, irritating	i	i	i	i	i i	i	i	N
F. Dahamana with Hatanaatan Chair	Cturatura	(Hataran alimana)																			
<b>5. Polymers with Heteroatom Chai</b> 5.1	POM	Polyoxymethylene and similar	1.41	1.6*		+			+ m, d, evaporates	(ac)	II	blue, almost	formaldehyde	i	i	i	i	i i	i	i	
5.2	PPO	acetal resins Polyphenyleneoxide (modified)	1.06	1.3*		+			+ becomes black, m, d, brown vapors	al	II	colorless difficult to ignite, then bright, sooty	first slight then phenol odor	i	s	S	i	i i	i	i	
5.3	PC	Polycarbonate	1.20	1.4*	+	+			+ m, viscous, colorless d, brown	(ac)	I	flame bright, sooty, bubbly, chars	first slight then phenol odor	i	sw	s	sw	sw sw	, i	i	
5.4	PETP PBTP	Polyethylene terephthalate Polybutylene terephthalate	1.35 1.41	1.5*	+	+		+	m, d, dark brown white deposit	ac	I/ II	bright, crackly, drips, sooty	sweetish, irritating	i	i	sw	i	i sw	i	i	PETP melts at 255°C PBTP melts at 220°C
5.5	PA	PA 66 Polymamides (crystalline) to	1.14	1.4*	+	+		+	above becomes clear, m,	(a)	I/ II	difficult to ignite, bluish yellow edge, crackly, drips	characterisitc odor similar to burnt horn possibly	i	i	i	i	i i	i	i	N, differentiate by quant. Analysis melting ranges
		PA 12 (amorphous)	1.02 1.12			+			+ d, brown			fiber forming	phenol	i	i	sw	i	sw i	i	i	PA 66: 255°C PA 6: 220°C PA
5.6	PSU	Polysulfone	1.24	1.5*	(-	+) +		+	+ m, bubbly, vapors invisible,	sac	II	difficult to ignite, yellow,	first slight amount, finally	i	s	s	i	sw i		i	11: 185°C PA 12: 180°C
5.7	PI	Polyimides	~1.4		+ yellow	+			brown  + doesn't m, brown on strong heating,	al	0	sooty chars glows	H <sub>2</sub> S in the tube on strong heating phenol	i	i	i	i	i i	i	i	
5.8		Cellulose Derivatives				1			glows												

5.8.1	CA	Cellulose acetate	1.3	+	+	+	+	m, d, black	ac	II	m, drips yellow green with sparks	acetic acid + burnt paper	i i	S\ S		sw s 1	i s 1	i i	
5.8.2	CAB	Cellulose acetobutyrate	1.2	+	+		+	m, d, black	ac	II	l . '	acetic acid , butryic acid	<sup>1</sup> depo		· .	degree d		tylation sw i	
5.8.3	СР	Cellulose propionate	1.2		+		+	m, d, black	ac	П	they fall same as CAB	propionic acid,	i i	SI	w i	s	s	sw i	