

PLASTICS

This part of the tool kit consists of descriptions of the characteristics of the plastics used in the manufacture of the objects included in the toolkit. They are numbered in chronological order of when they came into commercial use. The numbers match the descriptions up with the plastics samples in the box with the green lid. There is more than one sample of some plastics in order to demonstrate the variety of its range as a material. Samples made of the same material bear the same number.

You may find it useful to remove the pages from the binder and place the relevant sample/s near the page where it / they are described. Further copies of the pages can be downloaded as a PDF from:

<https://www.modip.ac.uk/projects/identifying-plastics-toolkit/travelling-toolkit>.

PLASTICS**1****Vulcanised rubber**

made from chemically altered natural rubber. The process involves heat and sulphur

Group:	thermoset
Developed:	reaction when heated with a large percentage of sulphur to make it rigid discovered in 1839; still in use in 1930s
Trade names:	none but also known as ebonite and in USA as hard rubber
Process:	compression moulding; fabrication; turning
Colour:	typically black (fades to brown) but can also be red
Transparency:	always opaque
Finish:	matt to moderately shiny
Rigidity:	rigid
Feel:	hard
Smell:	sulphurous rubbery
Typical uses:	vestas (match boxes); combs; fountain pens; imitation jet jewellery; denture palates (with pigmentation to resemble gums); pipe stems (good heat insulation)
Degradation:	becomes brittle; often fades to brown

PLASTICS**2****Bois durci**

blood albumen and powdered wood

Group:	thermoset
Developed:	patented in Paris 1855; UK 1856 described as ‘ a new composition of materials which can be employed as substitute for wood, leather, bone, metal and other hard and plastic substances’; exhibited 1862 and 1867 International Exhibitions, London; commercial production ceased in 1880s
Trade names:	Ebena
Process:	compression moulding
Colour:	black and dark brown, but sometimes has a lacquered finish
Transparency:	always opaque
Finish:	highly polishable; takes up texture of mould well
Rigidity:	always rigid
Feel:	hard, a feeling of solidity
Smell:	none
Other:	can sometimes be identified by the moulding of a small bird’s wing or by the name ‘Bois durci’ plus inverted number ‘2’.
Typical uses:	desk accessories; plaques with reliefs of notable people or mythological scenes
Degradation:	relatively stable; does not fade; tendency to chip;

PLASTICS**3****Cellulose nitrate (CN)**

Group:	thermoplastic
Developed:	displayed at 1862 International Exhibition, London; turned into an artificial fibre like silk in 1884 called Chardonnet silk; first common domestic plastic; use of all kinds almost ceases in 1940s except it is still used for ping pong balls.
Trade names:	Parquesine 1862 – 68; Xylonite (British) and Celluloid (USA) from 1870s
Process:	blow-moulding; fabrication, made into blocks that are sliced into thin sheets; thermoforming of thin sheets
Colour:	any, including mottles, pearls and special effects such as imitations of tortoiseshell and ivory
Transparency:	transparent to opaque
Finish:	matt to glossy
Rigidity:	Wide range but usually thin and so quite flexible
Feel:	hard
Smell:	camphor (used as plasticiser), easiest to smell in containers with lids
Other:	blade marks from the slicing into sheets sometimes visible; flammable, hence its early demise
Typical uses:	collars and cuffs; dressing table sets and combs; billiard and ping pong balls; knife handles; jewellery and costume accessories; spectacles; toys; false teeth; sculpture e.g. by Naum Gabo; in mortars ; also as support for film and still photography and from 1940s archival material
Degradation:	internal cuboid crazing, becomes 'sugary' and cracks. Decomposition of the polymer releases nitrogen oxides, generating acidic wet bloom and ultimately breakdown

PLASTICS**4****Cellulose acetate (CA)**

Group:	thermoplastic
Developed:	first prepared 1865, adapted to form viscose silk 1892, but only developed as a hard material for commercial use from 1918 (although to form cellophane from 1908); not common until late 1920s. Use fell off in 1970s but interest currently reviving, as made from wood based cellulose, a renewable resource.
Trade names:	Celanese, Estron, Plastacele, Bexoid, Tenite, Clarifoil
Process:	early examples compression moulding; from about 1928 injection moulding
Colour:	any, usually plain but occasionally marbled
Transparency:	transparent to opaque
Finish:	matt to glossy
Rigidity:	strong but slightly soft, may be flexible in thin sections
Feel:	hard
Smell:	vinegar, when degrading
Other	will accept surface colouring
Typical uses:	as liquid to stiffen and waterproof fabric wings and fuselage of early aircraft. In solid form in spectacle frames; type-writer keys; negatives and film; toys; fancy goods e.g. by Lalique; sculpture e.g. by Naum Gabo; hair brush handles, especially Addis Ltd; also as supports for archival material from 1940s
Degradation:	shrinks, crazes, becomes 'sugary' and cracks. Acidic droplets; white bloom on the surface; and distortion (warping), a result of plasticiser migration

PLASTICS**5****Casein formaldehyde**

milk curds hardened with formaldehyde

Group:	thermoset
Developed:	patented 1899; little used since the 1980s
Trade names:	Lactoid, Erinoid, Galalith
Process:	extrusion; fabrication, usually machined to shape from sheet, rod or block; textures achieved by laminating sheet on sheet
Colour:	any, including mottles, pearls and special effects
Transparency:	usually opaque but some translucency when imitating tortoiseshell, horn and all the many decorative affects that could be achieved
Finish:	capable of a lovely polish
Rigidity:	firm but can flex
Feel:	hard
Smell:	occasionally of the formaldehyde used in its production
Other:	accepts surface dyeing; polishes to a brilliant lustre
Typical uses:	buttons, knitting needles, fountain pens, jewellery, dressing table sets, manicure sets, inlay in furniture
Degradation:	Surface crazes and cracks

PLASTICS**6****Phenol formaldehyde (PF)**

Encountered in two different forms: (A), by far the most common, is mixed with wood flour; (B) an unfilled version, produced as a clear syrup which can be cast in a mould and subsequently cured with heat.

Group:	A and B: thermoset
Developed:	A: 1907: not widely used until after 1915; still used for electrical appliances and saucepan handles. B: 1927.
Trade names:	A: Bakelite (90% of phenol formaldehyde was made by Bakelite); Mouldrite; Nestorite; Roanoid B: Bakelite; Catalin; Carvacraft
Process:	A: compression moulding B: casting, often cut sections of rod, tube etc; also carved
Colour	A: naturally brown but can be dyed black, shades of green, red and brown, often mottled sometimes in wood effects. B: naturally amber but can be dyed any colour except blue.
Transparency:	A: always opaque B: seldom transparent, often translucent and marbled sometimes opaque
Finish:	A and B: moderately shiny
Rigidity:	A and B: always rigid
Feel:	A and B: hard
Smell:	A and B: carbolic acid
Typical uses:	A: domestic items: radio, clock and hair dryer casings, ash trays, boxes; electrical fittings; car components, aircraft and military components; cooker knobs; kettle handles. B: napkin rings and bangles; desk accessories; wireless cabinets, especially American; jewellery; laminate surfacing, e.g. Formica™.
Degradation:	A: relatively stable but brittle, so can chip and crack, colours darkened by exposure to light, green becoming brown, also goes dull B: brittle and can chip but relatively stable; discolours

PLASTICS**7****Urea formaldehyde**

Group:	thermoset
Developed:	patents taken out 1915 but only becomes practical for commercial use as thiourea formaldehyde in 1925; Improved to urea formaldehyde in 1929; role taken by other plastics by 1950s developed by British Industrial Plastics (BIP)
Trade names:	Beetle; Beatl; Bandalasta; LingaLonga; Plaskon; Scarab
Process:	compression moulding
Colour:	naturally white but any slightly muted or pastel colour; also speckled and marbled effects.
Transparency:	opaque or translucent; never transparent
Finish	moderately shiny:
Rigidity:	rigid although thin mouldings can flex
Feel:	hard
Smell:	usually none but occasionally a faint smell of urine
Typical uses:	domestic wares, picnic sets; jewellery; electric fittings and casings
Degradation:	dulls, discolours, cracks; acquires an orange peel effect on the surface; badly affected by hot water; otherwise reasonably stable

PLASTICS**8****Polymethyl methacrylate (PMMA)** often called acrylic

Group:	thermoplastic
Developed:	1932, in commercial use from 1934, fashionable in 1960s
Trade names:	Oroglas, Perspex, Plexiglass, Lucite; Corian
Process:	initially thermoforming from cast sheet and fabrication; now also casting; extrusion; injection moulding
Colour:	any
Transparency:	transparent to opaque; better optical properties as glass
Finish:	usually shiny
Rigidity:	rigid
Feel:	hard
Smell:	none
Other:	takes a high gloss; dull sound when struck
Typical uses:	aircraft glazing; containers fabricated from sheet, e.g. handbags; blocks with embedded objects, jewellery, display stands, artists' paints
Degradation:	relatively stable; crazing resulting from stress; physical damage, especially scratches

PLASTICS**9****Polyamide (PA)**

Group:	thermoplastic
Developed:	1933; nylon trade name given in 1938
Trade names:	Nylon
Process:	extrusion; injection moulding
Colour:	any
Transparency:	transparent to opaque
Finish:	any
Smell:	none
Rigidity:	rigid to flexible depending on type
Feel:	varies; can be waxy
Other:	
Typical uses:	toothbrush tufts, combs, kitchen utensils, zips, Velcro; as textile fibres: carpets stockings, tents; glass-reinforced moulding compounds
Degradation:	discolouration, especially yellowing

PLASTICS**10 A&B****Polyvinyl chloride (PVC)**

Encountered in two forms: A plasticised; B unplasticised

Group:	A and B: thermoplastic
Developed:	known from 1870 but suitable plasticisers not discovered until 1933; wide use from 1940s, ongoing
Trade names:	B: Darvic; Welvic
Process:	A and B: all thermoplastic processes
Cost:	A and B: low
Colour:	A and B: any
Transparency:	A and B: transparent to opaque
Finish:	varies
Rigidity:	A: made soft with the use of plasticisers B: rigid
Feel:	A: varies, can be sticky (migration of plasticiser to the surface)
Smell:	none
Other:	A: scratches and indents with fingernail
Typical uses:	A: shiny leather-like fabric; fashion belts; flexible toys; inflatable furniture; cables; blood bags; flooring B: guttering, window frames, flooring; as co-polymer LP gramophone records from 1952
Degradation:	yellowing and darkening; migration of additives to the surface creating either a bloom or sticky surface, which may lead to embrittlement.

PLASTICS**11 A&B****Polyethylene (PE)**

Encountered in two different forms: (A) Low Density (LDPE); and (B) a High Density (HDPE)

Category:	A and B: thermoplastic
Developed:	A: 1933 low density but used for military purposes until 1945 B: 1953
Trade names:	A and B: Polythene A: Tyvek; Alkathene B: Alkathene; Hostalen; Rigidex
Process:	A and B: blow moulding; extrusion; injection moulding; rotational moulding
Colour:	A and B: any
Transparency:	A and B: naturally translucent but can be opaque
Finish:	A and B: matt to shiny
Rigidity:	A: flexible B: semi-rigid to flexible
Feel:	A: has a waxy quality
Smell:	A and B: wax
Other:	scratches with fingernail; currently LDPE is the plastic with the highest volume of use
Typical uses:	A: replaced enamelled kitchenware: bowls and other domestic wares, first squeezable bottles (e.g. for washing up liquid) packaging film e.g. carrier bags B: airtight food containers; milk bottles and crates; road cones
Degradation:	yellow, stiffens, and embrittles

PLASTICS**12****Polystyrene (PS)**

Group:	thermoplastic
Developed:	became a usable material in 1930s but not used commercially until after World War II
Trade names:	Lacqrene; Polystyrol; Styron
Process:	usually injection moulding; also extrusion; fabrication: especially cutting and sticking; foaming; thermoforming
Colour:	any, including streak and pearlescent effects
Transparency:	naturally transparent to opaque with pigments
Finish:	high gloss
Smell:	none
Rigidity:	always rigid
Feel:	hard, except when foamed
Other:	normally brittle but can be toughened, e.g. high impact polystyrene (HIPS); metallic ring when tapped; good for bonding
Typical uses:	disposable pens and razors; cutlery and vending cups; CD cases; yogurt pots; model kits; insulation and packaging food trays, hamburger and egg boxes, electronic equipment, when foamed
Degradation:	crazing; brittle and therefore chips

PLASTICS**13****Melamine formaldehyde**

Group:	thermoset
Developed:	commercially, post World War II; heyday in UK late 50s and early 60s (earlier and later in USA); still in use for picnic ware and ashtrays
Trade names:	Argosy; Gaydon; Melaware; Melmex
Process:	compression moulding
Colour:	any, often two-toned
Transparency:	always opaque
Finish:	often but not always shiny; capable of high gloss
Rigidity:	always rigid
Feel:	hard
Smell:	none
Other:	porcelain-like
Typical uses:	colourful table and picnic ware; ashtrays; a component of Formica™
Degradation:	relatively stable but scratches and stains

PLASTICS**14****Acrylonitrile butadiene styrene (ABS)**

Group:	thermoplastic
Developed:	from 1948
Trade names:	Cycolac. Novodur
Process:	injection moulding; extrusion (sheet); thermoforming
Colour:	any
Transparency:	almost always opaque
Finish:	glossy
Rigidity:	rigid
Feel:	hard
Smell:	none
Other:	A modified styrene with butadiene (rubber) particles that restrict cracking
Typical uses:	domestic appliance and computer housings; furniture; Lego
Degradation:	relatively stable but has tendency to discolour in the light

PLASTICS**15****Polypropylene (PP)**

Group:	thermoplastic
Developed:	from 1956; increase in use from 1976 when initial patents ran out; became fashionable in translucent sheet form in 1990s; now one of the most used plastics
Trade names:	Propathene
Process:	blow moulding; extrusion (as a fibre); injection moulding
Colour:	any
Transparency:	opaque to translucent, but can have clarifying agents added making it transparent; also comes as clear film (modern cellophane)
Finish:	matt to moderately shiny
Rigidity	fairly rigid but often also flexible
Feel:	varies
Smell:	none
Other:	can be moulded to create an integral hinge; can achieve reasonably glossy surface scratches with fingernail
Typical uses:	chair shells and garden furniture; luggage; car bumper; petrol cans; food wrappings; microwaveable meal trays; margarine tubs; netting; household goods; carpets; packaging; rope
Degradation:	relatively stable; can be degraded by UV light when used outdoors

PLASTICS**16****Polycarbonate (PC)**

Group:	thermoplastic
Developed:	from 1958
Trade names:	Makrolon; Lexan
Process:	blow moulding; extrusion; injection moulding
Colour:	any
Transparency:	frequently transparent but can be opaque
Finish:	capable of high gloss
Rigidity:	rigid
Feel:	hard
Smell:	none
Other	can be outstandingly strong
Typical uses:	safety and space helmets; compact discs and DVDs; as copolymer as mobile phone housings; car components; large bottles; glass substitute
Degradation:	stable but can crack

PLASTICS**17****Polyethylene terephthalate (PET), a polyester**

Group:	thermoplastic
Developed:	1941 announced as a commercial polymer; widely used in blow-moulded form from 1980s
Trade names:	related film Melinex and Mylar
Process:	especially blow moulding; injection moulding
Colour:	any
Transparency:	transparent to opaque
Finish:	shiny
Rigidity:	rigid or flexible
Feel:	varies
Smell:	none
Other:	strong
Typical uses:	carbonated drinks bottles; video and audio tape
Degradation:	relatively stable