

## Care and conservation of plastic materials

Plastics and rubbers form a significant part of our cultural heritage. They are found not only in art, historic and technological collections, they are also among the ethnographic materials of the twentieth century. Objects made from these materials range in diversity from radios, clocks, fountain pens, jewellery and hair accessories, to plastic robots and dolls, and all are becoming increasingly collectible.

Plastic is a generic term covering all types of synthetic materials. These different types of materials may differ dramatically from each other with respect to their care requirements. It is, therefore, most important to try to identify the type of plastic from which the object is manufactured.

### Plastics are commonly classified on the basis of their origin:

Natural - These include amber, horn, wax, shellac, rubber

Semi-synthetics - These are chemically modified natural materials like:

Hardened rubber (Ebonite, Vulcanite), casein (Erinoid, Galalith), which is based on milk protein, cellulose nitrate and cellulose acetate, both based on cellulose.

Synthetics - These may be further sub-divided into:

- Early synthetics: phenol formaldehyde (Bakelite), urea formaldehyde (Beatl, Beetle);
- The 'poly' era: polyvinyl chloride (PVC), polymethyl methacrylate (Perspex, Lucite), polyethylene (Polythene), polyamide (Nylon), polyacrylonitrile (Courtelle, Orlon), polyurethane, polycarbonate, polyester, etc.

### Identification of plastics

Although the unambiguous identification of a plastic material requires the use of sophisticated equipment, sometimes an 'educated guess' is sufficient. The probable date of the object, the appearance, feel and smell of the material, and the properties necessary for its use are important clues. For example:

- A hard, dark material from the 1940s, with a Carbolic smell, which was often used in electrical goods is probably a phenol-formaldehyde or Bakelite.
  - A flexible clear (or yellowed) material from the 1940s is probably polyvinyl chloride, PVC. Flexible PVC was commonly used in the manufacture of shoes and rainwear in the 1960s and 70s. It was also the main material used in the manufacture of toys such as dolls from the late 1940s onwards. It has a distinct and unique smell of plasticiser.
  - A hard, light-coloured material, used decoratively and in objects dated 1910-1930, is likely to be a casein-based plastic. Casein is commonly found in buttons, pens, costume jewellery, and dressing table sets. It was also used in the manufacture of decorative inlays in furniture and lamps.
  - Dolls, dressing table accessories, combs and, generally, decorations from 1930-1950 are frequently made from cellulose acetate. This can have a smell of vinegar - acetic acid.
  - Imitation tortoiseshell is likely to be cellulose nitrate (which smells of camphor). Early film stock is also made from this material.
  - Polystyrene was used extensively in the 1940s and early 1950s for hard, brightly-coloured toys,
  - Foam toys are usually natural rubber or polyurethane,
  - 'Bendy' (brand name) toys for example are usually natural rubber. This material may often have an associated smell of sulphur.
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- A conservator specialising in this field can help you identify the material and manufacturing process used in making your object or collection. This will help you

catalogue and document your items and give you clues as to how best to keep them in good condition.

## **Recognising signs of deterioration**

### **Cellulose nitrate**

Cellulose nitrate is affected by light and moisture and releases potentially dangerous chemicals during degradation. Do not store items made from this material in plastic bags or other packaging with restricted ventilation. Early signs of breakdown include a smell of camphor, disintegration of wrapping tissue, surface bloom and yellowing.

Note that cellulose nitrate-based film may deteriorate and disintegrate at room temperature. Cinema film in particular can combust spontaneously. All cellulose nitrate film stock should therefore be isolated, and advice on storage sought from the Fire Brigade.

### **Cellulose acetate**

Cellulose acetate degrades in a similar manner to cellulose nitrate, but with the production of acetic acid, hence the vinegary smell. The migration of plasticiser to the surface of the object can result in a "tacky" surface.

### **PVC**

The main breakdown problem associated with PVC is the loss of its plasticisers. This results in a sticky deposit on the surface which attracts dirt, and in the material becoming more rigid and liable to crack and go yellow.

### **Casein**

The problems most usually associated with this material are cracking and splitting due physical and environmental stresses.

- A conservator can give you advice on how to deal with all of these problems and whether specialist treatment is necessary (or effective).

## **What you can do - Storage**

Storing plastics at low temperatures and relative humidities will slow down the rate of degradation reactions. Plastic objects should also be kept in low light levels.

Some objects require special care, especially those made from cellulose nitrate and acetate. These should be stored in a cool, dry atmosphere. Never store them in humid surroundings such as laundry rooms as this can cause warping.

If objects show signs of degradation - such as a smell of vinegar or camphor, it is best to separate them from other objects. Either leave the plastics loosely covered with acid-free tissue or even silicone paper to stop dirt getting at them if there is a strong acid smell. If there is any surface acid you could remove it with a dry tissue (it might stick, so be careful), or a very lightly water-moistened one, but do dry the surface carefully afterwards.

## **What you can do - Cleaning**

As solvents may react with specific plastics, causing stress-cracking it is best to avoid their usage. Mechanical "dry" cleaning such as brushing and dusting is the best way to remove surface dirt. You can also use cotton swabs dampened slightly with water, but make sure the surface is dried thoroughly afterwards.

## **Consulting a conservator**

As owner and collector of plastic items, you can prevent damage by improving storage and

protection as above, but there are instances where a conservator experienced in this field can provide invaluable help.

- Plastics are different – the exact make-up and “recipe” of each type of material has a great deal of influence over how long it will survive or stay looking good. Even individual colourings within the same type of object can make a difference. A conservator can help analyse and precisely identify the type of plastic you have in your collection. You will then be best informed about how to care for it.
- Plastics are difficult to stabilise once they have started to deteriorate and they can fall apart quickly. A conservator can carry out treatment to stabilise certain plastics and can make enclosures and storage environments to stabilise an item at the very least.

Use the Conservation Register to [Find a conservator](#).

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