

## **Plastics and Modern Materials**

**Found in such items as beads, buttons, utensils and decorations**

### **Identification and General Information**

Many modern items contain plastics and other synthetic materials. Here the term *modern materials* includes synthetic materials from the 1860s to the present. European industrialists and scientists developed these materials to replace natural substances such as shell, bone, and ivory. These materials were used for ornamentation as well as for every-day and also special-occasion three-dimensional objects of many types.

Plastics are the most widely used modern material, and many different ones are available. Identification of a particular plastic is generally not possible without conducting tests that involve cutting, burning, or dissolving part of the item, so they will not be discussed here. Contact a conservator for further information and advice on the identification of plastics.

Plastics deteriorate for a variety of reasons including heat, moisture, light, and physical stresses. Some plastics will slowly self-destruct, especially cellulose nitrate and other early synthetics. These suffer from inherent vice: they are materials that have an innate tendency to deteriorate. Cellulose nitrate turns yellow and becomes brittle over time. Although proper storage conditions will slow the process, nothing will stop the ultimate loss of the item. Deteriorating plastics release acids and other chemicals. These breakdown products can affect other, more stable plastics and non-plastic materials that are in proximity in storage or display. Problem plastics should therefore be separated from other materials if possible.

Deterioration from ultraviolet light, heat, physical stress, high relative humidity, and contact with low-quality storage and display construction materials can cause the following chemical effects:

- color changes,
- chalkiness or surface bloom,
- crazing or cracking,
- embrittlement,
- release of breakdown products, and
- softening and stickiness.

Signs of deterioration include

- distortion or dimensional change,
- crazing or cracking,
- surface deposits that are often sticky,
- less flexibility,
- odor, and
- a change in texture or color.

### **Basic Care and Storage**

Since many plastic items were considered disposable, they were not manufactured to endure.

You need to provide the best possible storage conditions to counteract this characteristic.

Optimum basic preservation in collections involves consistent temperature and humidity. Follow the recommendations in *Basic Care*. Stable, cool, and dry conditions are best.

Many plastics, especially urethane foams, are particularly prone to degradation by ultraviolet and infrared light. Plastic items should be stored in the dark. Avoid storing items near radiators, heat pipes, outside windows, or incandescent lights. These poor conditions can cause excessive drying.

Never apply pressure-sensitive tape or self-adhesive labels to the surface of plastic items. The adhesives can eat into the surface of plastics and are difficult to remove without causing further damage to the item. Do not stack plastic items within one another; this will cause physical distortion over time.

### **Special Pest Concerns**

Plastic materials can develop mold growth under extreme conditions, for example, if the relative humidity in the storage or display area is allowed to exceed 60 percent for relatively long periods. Mold infestations can be recognized by a fuzzy white or greenish growth on the surface of objects. Good ventilation and air circulation in storage and display areas will help to prevent mold infestations. If mold growth does occur, take measures to reduce the relative humidity to which the items are exposed, and contact a conservator on how to clean the surfaces safely. Many types of mold can cause serious and permanent health problems. Personal safety is the primary concern when dealing with mold infestations.

Insects will not usually attack plastic items. In fact, the absence of insect damage can be a way to tell imitations from natural products. Natural shell and bone products are attacked by dermestid beetles and will have small round holes in them if infested. Imitation plastic products will not have any holes.

### **Routine Handling**

The general methods and techniques for the proper handling of all items apply as well to plastic items. Always wear gloves when handling plastic items since the acids and salts in sweat and on fingerprints can permanently mark the surface. In addition, body oils can stain the porous plastic surfaces, especially those that are light colored.

When lifting and moving an item composed of or including plastic, make certain that it is supported well and that no stress is being put on weak areas or attachment points. Use a tray or other support if necessary. This can be made from a piece of acid-free corrugated board that is cut to the standard sizes of drawers or other storage units.

### **Display Issues**

The temperature and relative humidity ranges mentioned above also apply to display conditions. It is important that plastic items used for display be protected from high light levels, ultraviolet radiation, and heat from incandescent lights and sunlight, because these items are especially prone to damage from light and heat. Incandescent floodlights inside cases and dioramas generate a lot of heat and can cause extreme drying. Lights should usually be outside of cases. See *Display* for other general display concerns.

### **Mounts and Supports**

Avoid using adhesive mounts. These can cause irreversible damage to the surface of the items, resulting in staining and loss of surface texture. The solvents in the mounting adhesive can dissolve the surface of the plastic item, causing permanent damage. If the adhesive bond fails, the item can fall from its mount. It is better to grip items to mounts with padded wires or flat acrylic plastic clips rather than to pierce the surfaces with fasteners. Avoid using unpadded wires or attaching items through existing holes with fasteners such as screws.

External supports can be fabricated from acrylic plastic sheeting, such as Plexiglas, and shaped with heat to conform to an item's surface shape. This requires only minimal tools and training. Standard-size mounts are available from some suppliers, though they can be expensive and hard to use with unique items.

## **Cleaning and Minor Repairs**

Plastic materials are prone to getting dirty during storage, handling, and use because many have an electrostatic charge and attract dust. Others slowly bleed plasticizers to the surface and become tacky. Plastic items rarely develop an attractive appearance from the combined effects of aging, wear, and polishing as ivory and stone do. The few plastics that do so are those for which color is only a small part of their attraction, for example, vulcanite and molded Bakelite. In such cases, cleaning with a dry soft brush or cloth is probably all that is necessary.

The best method for the long-term preservation of plastics is periodic inspection and maintenance. Check for loose attachments before cleaning an item. Remove surface dust with a variable speed vacuum, brushes, and micro-attachments.

In addition, plastics, with certain exceptions, can be cleaned periodically to remove surface contamination that may have built up over time. How frequently plastics should be cleaned will depend on how dirty they get. With cellulose-based materials, such as celluloid and cellulose acetate, and casein, plastics made with a milk protein, it is recommended that cleaning be done at least once every five years.

Plastic objects that are stable and have no metal, fiber, or fabric attachments should be washed with tepid water containing a small quantity of mild liquid detergent, such as unscented dishwashing soap. You may need to use a small brush for textured surfaces. Afterwards, rinse the materials with clean water, and immediately dry using an absorbent cloth. Do not soak for long periods. It is much better to rewash if soiling remains. Degrading cellulose nitrate and cellulose acetate (identified by visible crazing or porous areas) should not be washed. Be careful with objects containing metals that might corrode, or with hollow objects that may be difficult to dry on the inside. We suggest disassembling these composite objects before cleaning, if this can be done safely and without risk to the item. If items are tacky, isolate them, because a degrading

plastic can affect anything else it touches.

Using commercial adhesives to repair cracks and breaks is discouraged, as these repair methods are difficult and may result in staining and further breakage as the adhesives age. In addition, breaks and cracks may provide useful information and evidence of use. Unnecessary repair of such damage can obscure historical evidence.