



Care of Plastic Objects

Kansas Museums Association
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History of Plastics



Alexander Bally
Brigade Firefighter Helmet
1984
Museum of Modern Art



Mario Bellini
Lexikon 83DL Typewriter
1970
San Francisco Museum of Modern Art

Plastic in the Archives



Terminology

Polymer:

– Monomer

– Polymerization:

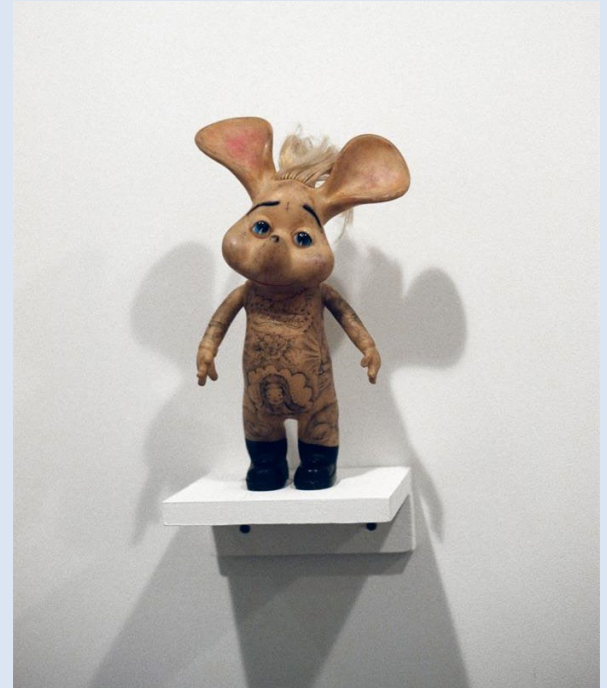
– Copolymer

• Alternating: 121212121212

• Random: 122211212212

• Block: 111222111222

• Polymer vs. plastic



Dr Lakra
Untitled
2000
Larry Qualls Archive



Plastics

Thermoplastic



Tom Wesselmann
Seascape
Vacuo-form plastic
Spencer Museum of Art,
University of Kansas

Thermosetting



Siemens & Halske A.G., Munich, (Manufacturer)
1955
Museum of Modern Art

Early plastics



Shoe Form Co. Inc.
Bait box (celluloid)
Before 1946
The Museum of Modern Art,
Architecture and Design Collection




Le Corbusier
Swiss Pavilion, Cité Universitaire Paris, France
1930-32
Museum of Modern Art



Plastic ID

- Appearance
- Hardness
- Density
- Odor
- Melting properties (if sampling possible)
- Solubility (if sampling possible)
- Degradation

<https://plastic-en.tool.cultureelerfgoed.nl/>



“Non-malignant” vs. “Malignant” Plastics

Non-malignant

- Acrylics
- Styrenes
- Polypropylene
- Polyethylenes
(Mylar, PETE)
- Nylon

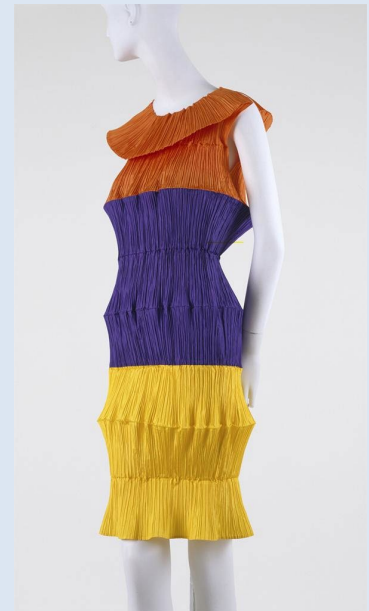
Malignant

- Cellulose nitrate
- Cellulose acetate
- Polyurethane
- Polyvinyl chloride
(PVC)



Plastics degradation: Induction period

- When degradation actively begins to occur
- When symptoms seen, too late to go back
- Each plastic has own typical induction period



Issey Miyake
Dress (polyester), 1994
Metropolitan Museum of Art

How to inhibit plastic degradation?

- **Identify the type** of plastic
- **Adsorb gases** that drive deterioration
- **Lower storage temperature**

Boudoir slippers, 1950-59
Brooklyn Museum Costume Collection
Metropolitan Museum of Art



Plastic ID: Cellulose nitrate



Disney Studios,
1937
Squirrels
Smith College
Museum of Art



Lewis W. Hine
Mother and Child
ca. 1903-1938
George Eastman House



Hair comb
Getty Museum



Plastic ID: Cellulose nitrate deterioration



- Crazing
- Smell of mothballs
- Distortions
- Return to crystalline structure (advanced deterioration)
- **Highly flammable**

Plastic ID:

Semi-synthetic: Cellulose acetate



Elsa Schiaparelli
Rhoidid (cellulose acetate plastic) necklace
1938
The Metropolitan Museum of Art

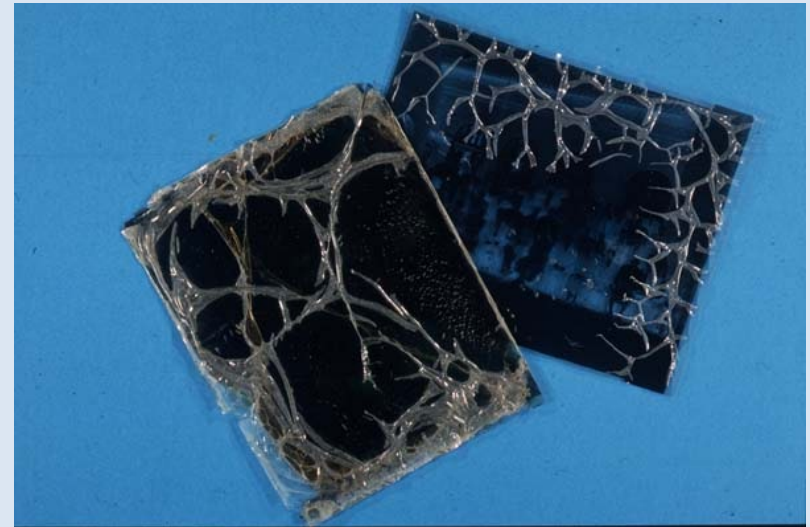




Plastic ID:

Cellulose acetate deterioration

- Offgas acetic acid (vinegar smell)
- Blistering
- Cracking
- Weeping
- Delamination

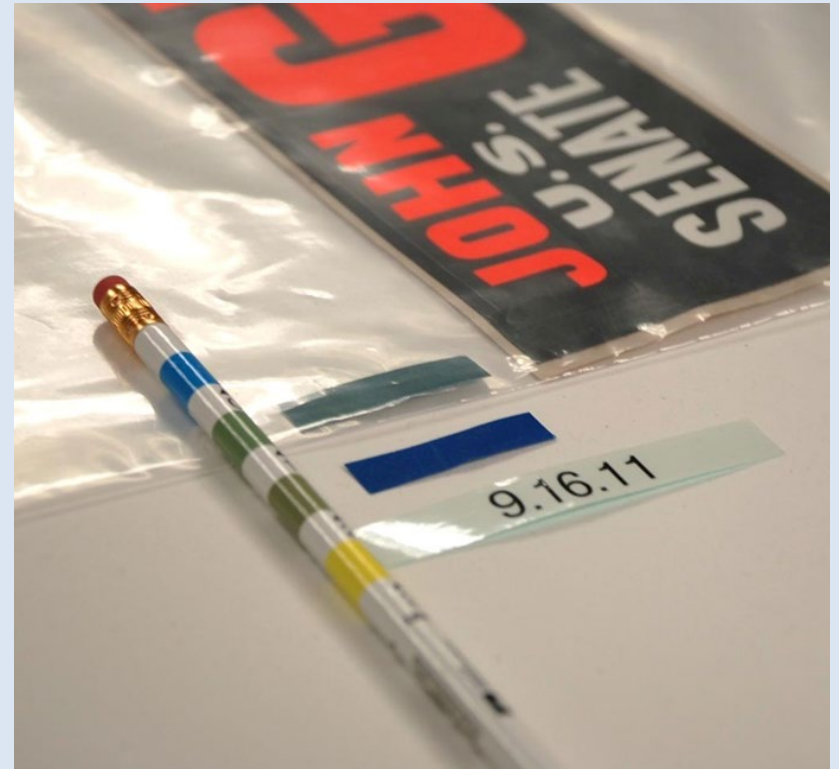




Plastic ID:

Cellulose acetate deterioration

- Acid Detection (A-D) strips from Image Permanence Institute
- Visual representation of cellulose acetate decay (vinegar syndrome)



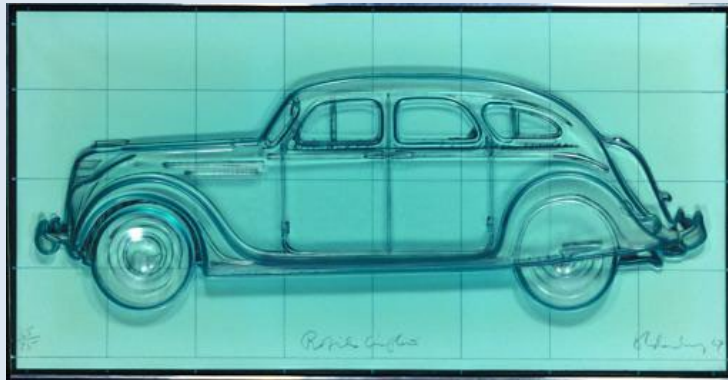
A-D Strips from Image Permanence Institute



Cellulose nitrate and acetate: Storage

- Most effective: Archival Boxes
 - Polypropylene film canisters
 - Paper
- Ventilation to release gases
- Cold storage
- Effective but potentially impractical:
 - Adsorbents (activated charcoal, zeolites)

Plastic ID: Polyurethane (PUR)



Claes Oldenburg
Profile Airflow
Molded polyurethane relief over 2-color lithograph in
aluminum frame
Spencer Museum of Art, University of Kansas



Athena Tacha
Brain Cancer Headdress for Maro
Oyster shell, polyurethane foam, clay, glue
1992
Spencer Museum of Art, University of Kansas



Plastic ID:

Polyurethane (PUR) Deterioration

- Discolors
- Pungent odor
- Cracks start from outside and work inwards
- Main issue is **oxidation** (reacting with oxygen in the air)
- UV light often necessary for oxidation
- Once oxidation has started can't undo damage

Polyurethane (PUR): Storage

Oxygen scavenger (Ageless) in a sealed enclosure



Polyurethane (PUR): Storage



Insects Limited

Polyester bag (plastic with metal coating: Escal, Marvelseal)

- Flush out bag to remove oxygen
- Double bag
- Don't use this approach if item will be removed frequently. Needs at least 6 months a year in storage


Plastic ID: Polyvinyl chloride (PVC)



PVC (vinyl): Deterioration

- Yellowing
- Stickiness
- Plasticizer weeping
- Distortion





PVC (vinyl): Storage

- Don't use adsorbents (including tissue)
- Store in sealed, non-adsorbent containers
 - Glass containers
 - Sealed polyester envelopes (Mylar)
 - Archival box lined with polyester (Mylar)
- Cool or cold storage slows degradation

Cool/cold storage



National Park Service

- Barrier around object
- Keep in cold storage for a long period of time, otherwise not worth it
- Have to re-acclimate to room temperature
- Not ideal for some composite objects



Storage summary

- KNOW THE PLASTIC
- Segregate actively deteriorating items
- Low temperatures (freezer) possible and recommended for most plastics
- Adsorbents: CN and CA
- Oxygen scavengers: PUR
- Sealed polyester storage: PVC

Caring for plastics: General storage

- Archival box
- Polyester/polypropylene
- Avoid wrapping item completely in tissue or cloth
- Separate plastics from metal and cellulosic items (paper, photographs, textiles)



Caring for plastics: Environment



Ibeji Dolls, Nigeria
1988
Fowler Museum at UCLA

- Inspect regularly
- Keep away light
- Constant T and RH
- Limit pollutants

Caring for plastics:

Storage: Mixed items

- If not a malignant plastic, **leave in place** (casein buttons, nylon, polypropylene, etc.)
- Some might not be good for freezing
- New items in plastic packaging:
 - If in good condition, leave in place
 - If plastic wrapper is cloudy, plasticizer is leaching
 - Don't disturb packaging unless see degradation signs





Caring for plastics: Handling

- Support fragile parts
- Cradle objects—don't handle by weak parts
- Nitrile, not cotton, gloves
- Wash hands before and after
- Minimize transfer of surface contamination
- Sniff odors cautiously



Plastics: Exhibit

- 50 lux for no more than 6 months
- If already degrading, 6 months absolute limit
- Easier to limit time than light levels
- Consider surrogates





For more information

- Shashoua, Yvonne. 2008. *Conservation of Plastics: Materials science, degradation and preservation*. Amsterdam: Elsevier.
- Plastics Identification Chart (Cultural Heritage Agency, the Netherlands): <https://plastic-en.tool.cultureelerfgoed.nl/>
- POPART: Preservation of Plastic ARTefacts in museum collections: <https://popart-highlights.mnhn.fr/>

Thank you!

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