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### Plastics

There are five different thermoplastic films used to fabricate mounts, sleeves and pages for displaying stamps and covers:

**PET** polyethylene terephthalate (marketed as "polyester" or "Mylar<sup>®</sup>" or "Melinex<sup>®</sup>")

**PVC** polyvinyl chloride

**PE** polyethylene

**PP** polypropylene

**PS** polystyrene

The commonly held notions are that PET is good, i.e., safe to come in contact with philatelic materials, and that PVC is bad. Recent articles by Dr. William E. Souder [1, 2] concludes that these widely accepted ideas are unproven. This section is based on Souder's findings.

Much scientific information is available on these five thermoplastic films. However, much of this scientific information is not very practical for stamp collectors. Dr. Souder's article "Stamps in Plastics, Three Year Oven Test" tests a wide variety of stamps under real world conditions to show the effects of all of the plastics used in philatelic materials. It is certainly recommended reading for those who are concerned with mounting and storage of their collectibles.

A concise version of the following can be found in a Power Point presentation by Roger Rhoads entitle *Stamps and Plastics – the Good and the Bad* that can be viewed by clicking here (will post web address once new site goes live).

## PET

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Archivists advocate the use of archival films; Dupont Mylar-D<sup>®</sup> being a leading example. However, "archival," aside from the general meaning "chemically stable," is imprecise. "Archival" is an imprecise, non-technical term that has no exact definition. In other words, "archival" and "safe" are relative terms unless there are scientific standards to back them up.

After contacting seven leading international repositories of stamps and other historical documents, Souder concluded that "No standardized scale for measuring the degree of 'archivalness' exists." Though their needs and concerns differ from those of most stamp collectors, the experienced opinions of archivists must be considered as valuable advice for storing philatelic materials. But, for PET, our youngest and least experienced film, there have been no scientific experiments on the results of storage over period of several decades, or longer.

On the negative side, PET readily degrades in sunlight unless it contains ultraviolet inhibitors that may do damage to stamps. Indeed, a test in which stamps were heat and light tested in PET plastic products made for stamps showed yellowing and embrittlement of the plastic after four months of six hour/day exposure to summer sun.

Also, due to limitations in fabrication technologies, PET films are not widely available in the variety of forms desired by stamp collectors.

Collectors should also be aware that Mylar D<sup>®</sup> is no longer being manufactured as DuPont has sold that business, but not the copyright name. However, Melinex type 516, Melinex type 456, and SKC type SH72S are all equivalents and are suggested by the Library of Congress.

## PVC

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PVC, popularly known as "vinyl," is the most controversial of the plastic films considered here. Even though it is one of our oldest and most successful plastics, in use for scores of household products, PVC has been the brunt of environmental and health criticisms and has been cited as destructive to collectible postage stamps.

In fact, there are two different types of PVC, plasticized (pPVC) and unplasticized (uPVC). pPVC is uPVC with plasticizers blended into it. This makes it more flexible, and it is often called "soft" or "flexible" PVC. However, plasticizers are demonstrably bad for stamps. uPVC is often called "hard" or "rigid" PVC, and it appears to be harmless to stamps. As Souder points out, the terms flexible/soft and rigid/hard are confusing because they refer to the polymer blend and not to products made from that polymer. Thus, highly flexible films can be made from "rigid" uPVC.

Although PVC, even uPVC, has not been subjected to every imaginable test, Souder is able to debunk the following eight misconceptions commonly held about the film:

1. "PVC films exude hydrochloric acid at room temperature." This results from confusion with thermally unstabilized PVC polymers. Products made from uPVC polymers are thermally stabilized to 275<sup>0</sup>F and cannot exude anything at room temperature.
2. "PVC films release chlorine gas as they degrade." As in 1., thermally stabilized PVC polymers do not degrade at room temperature. Even the unstabilized polymers degrade into hydrochloric acid and a charred mass. Not gas.
3. "PVC has loosely bound chlorine atoms that can attack stamps." As in 1. and 2., stabilized uPVC does not exude or degrade at temperatures below 275<sup>0</sup>F.
4. "PVC is degraded by humidity." This is easily refuted by the fact that the pipes in many of our homes are PVC!

5. “uPVC is a blend of many chemicals.” This is incorrect, according to Souder. Modern uPVC films for stamps are typically 98-99 percent uPVC co-polymers, with 1-2 percent thermal stabilizer added to them.
6. “PVC films contain plasticizers that dissolve inks on stamps.” This confuses uPVC with pPVC. Note that uPVC contains no plasticizers.
7. “PVC is a deadly poison.” According to Souder, this is incorrect, although he quotes literature on its possible environmental hazards.
8. “PVC degradation can be detected by a skunky odor.” There have been reports of philatelic damage from uPVC films that may possibly be traced to improper formulation of the resin. Dr. Souder, with many years of experience with PVC formulations, opines that mercaptoester stabilizers may be at fault in these isolated situations. Organo-sulfur stabilized PVC compounds will stink like rotten eggs. Some form of sulfuric odor always accompanies them, whether it is excess H<sub>2</sub>S, SO<sub>2</sub>, etc. These odors indicate the presence of these reactive materials that can cause damage to philatelic collectibles. In other words, if the film smells like rotten eggs, do not use it.

In summary, uPVC appears to be free of problems for stamp collectors, and has been used for many years without any serious issues. Dr. Souder’s article on three year oven testing shows that uPVC performed equally as well as the other commonly used films. Only pPVC and glassine performed unacceptably.

## PE

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Polyethylene films are highly flexible and are somewhat cloudy which preclude their use as mounts. However, they are easy to fabricate into cover protectors and are relatively inexpensive. They begin to soften at 150-230<sup>0</sup>F, well above the expected usage conditions of the films.

## PP

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Polypropylene films have high flexibility with acceptable clarity, and they soften and degrade at high temperatures, similar to PET films. In the three year oven test, PP films performed very well.

## PS

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Polystyrene films are relatively rigid and very clear. However, at elevated temperatures, they tend to shrink and buckle as noted in the three year oven test at temperatures to 95<sup>0</sup>F.

All of the films discussed here have performed without major problems in the conditions required by stamp collectors with the exception of pPVC. However, more testing with stamp protection in mind is certainly required. The three year oven test was not an archival test. It only evaluated what might be expected with these materials in normal usage over a rather short period of time.

Collectors may readily test the materials they own as to their generic types. First of all, is the film clear? If yes, then it cannot be PE. Next, put a flame to a sample (in a well-ventilated area). When the flame is removed, PS, PET and PP will continue to burn. PS will give off copious amounts of smoke with small black particles floating upwards. PP will smell like a burning candle or wax. PVC will self-extinguish, and the flame will go out. It will not support a flame. Avoid all products where the supplier is not forthcoming with information as to the chemical nature of the materials

[1] William Souder, Waldo's Century, *American Philatelist*, December 2000, 1102-1106.

[2] William Souder. "Stamps in Plastics, Three Year Oven Test", *American Philatelist*, April 2005 328-332