Combustion of KODAK Films, Resin-Coated Photographic Papers and Print and Display Materials

Most films and resin-coated photographic papers are no more hazardous under fire conditions than other cellulose-based, wood, or fabric materials of equivalent shape and weight. The following discusses the combustion characteristics of Kodak films and paper.

FILMS

Films on ESTAR base or cellulose triacetate base are not readily combustible materials. Potential hazards in most use and storage situations are small. The thickness of the film base has a significant effect on its burning rate; the thicker the base, the slower the combustion.

Burning ESTAR or Cellulose-triacetate base films produces carbon monoxide, carbon dioxide, water, and numerous organic compounds, which may include various aldehydes, alcohols, ketones, and acetic acid. In addition, smaller amounts of oxides of nitrogen and phosphorous may be produced. The precise compounds evolved depend on the completeness of combustion, temperature, and other process conditions, e.g., availability of oxygen. These vapors or gases may be odorous and irritating to the respiratory tract and eyes, especially in poorly ventilated areas. Under comparable conditions, the combustion products of burning ESTAR and cellulose-triacetate base films are similar to those of wood.

All Kodak films pass the standard burning test for safety film described in ANSI/ISO 543-1990 *Photographic Films-Specifications for Safety Film.*

RESIN-COATED PHOTOGRAPHIC PAPERS

Resin-coated photographic papers have a burning rate equal to or less than other cellulose-based products of similar thickness. Tests of resin-coated paper show that the presence of emulsion and polyethylene layers retard the burning rate. The flame-retarding effect of the surface coatings decreases as the thickness of the paper stock increases. Adhesion to a mounting board or a wall increases the amount of thermal energy required for ignition, and also retards the rate at which flames spread. Dry-mounting tissue and other adhesives used to mount prints may contribute to the gases released by combustion.

The combustion products of photographic paper are similar to those of film under comparable conditions. Burning will produce carbon dioxide, carbon monoxide, water, and many organic compounds, which may be odorous and irritating to the respiratory tract and eyes, especially in poorly ventilated areas.

DISPLAY AND PRINT MATERIALS

Many Kodak imaging products* are available in large formats and are frequently used for large public displays. These products include, but are not limited to, polyester and other plastic films, and resin-coated papers. Large displays of these products, and similar materials made by other manufacturers, pose unique burning characteristics. These burning properties, as well as applicable standards and regulations, need to be taken into account in preparing to use these products (see the following).

* Products include: KODAK PROFESSIONAL ENDURA Transparency Optical Display Material, KODAK PROFESSIONAL ENDURA Clear Optical Display Material, KODAK PROFESSIONAL DURAFLEX Print Material, KODAK PROFESSIONAL ENDURA Transparency Digital Display Material, KODAK PROFESSIONAL ENDURA Clear Digital Display Material, KODAK PROFESSIONAL DURAFLEX Plus Digital Display Material, and KODAK Wide-Format Inkjet Media

PROTECTING DISPLAY MATERIALS

Many municipalities have incorporated into their local fire codes the provisions of the National Fire Protection Association (NFPA) document titled, *NFPA 101, Life Safety Code*. The Life Safety Code cites NFPA Standard 255 for the flame spread characteristics of “interior finishes” used for display and decorative purposes inside buildings, and NFPA Standard 701 for determining flame resistance for “free hanging” textiles and films. Brief descriptions of NFPA 255 and NFPA 701 follow:

NFPA 255: *Standard Test Method for Surface Burning Characteristics of Building Materials*. The test method developed under this standard is also known as the ASTM E 84 Test and is equivalent to Underwriters Laboratories UL723 and Uniform Building Code UBC No 8.1. The test measures the burning behavior of the material tested, and provides a Flame Spread Index and a Smoke Developed Index. Occupancy classifications are given to the material based on the Flame Spread Index.

ASTM E84 Test Result and Classification

ASTM E84 Flame Spread Index	NFPA Classification
0 - 25	A
26 - 75	B
76 - 100	C

For all three classes, the Smoke Developed Index (a measure of smoke) shall not exceed 450. The Life Safety Code details the various occupancies and the required classification for those listed occupancies. Class A is the most desirable and Class A materials have few end use restrictions. B and C can be widely used but some limitations may apply in certain occupancies. ASTM E 84 test data are available for several Kodak display materials upon request.

NFPA 701: *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films* (Free hanging materials). Tests are conducted on vertically mounted samples. The weight losses of the samples due to burning and the characteristics of fragments and residues during burning are evaluated for specified 'pass/fail' criteria.

Note: Kodak's products are not designed for use in a free-hanging configuration, and therefore, are not anticipated to be in conformance to the NFPA 701 standard. When using Kodak's display materials in a free-hanging configuration in a public area, to assure compliance with this standard, we strongly recommend that you frame and laminate the materials to a non-combustible mounting board, wall, glass, or ¼- inch or thicker polycarbonate, e.g., Lexan, support.

Other standards or similar tests covering the burning characteristics of these products may apply to markets outside the U.S. Check with the appropriate local agency or authority having jurisdiction.

PROTECTION AGAINST FIRES

Fires can be devastating to film and prints. A “fireproof” storage vault located and constructed in accordance with local building codes and underwriters' regulations offers the best protection for large collections. The vault should have enough insulation to provide satisfactory temperature control all year round, prevent moisture condensation on the walls, and provide significant resistance to internal temperature increases in the event of a fire.

For smaller collections, a fire cabinet or safe will provide increased protection in the event of fire. Fire resistant cabinets or safes should be carefully selected because some types contain insulation that releases moisture, e.g. steam, when heated, which can damage photographic emulsions. Before storing any films or prints in this type of safe, seal them in moistureproof, photographically inert storage envelopes. Alternatively, you can place film in metal cans and seal the cans with several layers of moistureproof tape such as vinyl electrical tape.

Bear in mind that specifications for “fireproof” vaults, files, or safes are usually based on the charring combustion point of paper. The gelatin emulsions on films and prints are subject to damage *well below* these standards. Therefore, such storage devices may not provide protection for photographic materials over the stated temperature ranges or conditions. Heat may cause extreme dryness resulting in brittleness or other physical damage to film or prints. Similarly, heat can cause the gelatin surface of photographic materials to soften so that it is still subject to damage through melting, embossing or impressions in the surface, digs and pick-off, adhesion to other surfaces, etc.

Generally, if the fire protection prevents the temperature from rising above 100°F, most materials will not be adversely affected. However, when temperatures exceed l50°F, most photographic products will be susceptible to damage; between 100 and l50°F, results will vary by product and condition. Keep the lower tolerance of photographic materials for such temperatures in mind when selecting or designing fire resistant storage facilities. Similarly, your expectations for films and photographic papers surviving a fire should be based on these considerations. Prevention is still the best protection.

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