A PERIODIC PUBLICATION HIGHLIGHTING THE MERITS OF VINYL PERFORMANCE PRODUCTS

FOCUS on Flammability Resistance

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FOCUS ON FLAMMABILITY RESISTANCE

In a fire, the time available to building occupants to escape or be rescued makes the difference between life and death. Today, interior designers are seeking guidance for selecting those components of contract furniture that will be most protective of lives and property in commercial settings. The place to start is by first understanding the mechanics of a fire, the components of modern building materials, and the products that can disrupt the normal fire sequence so that it doesn't become deadly.

Three components must be present in a fire – a solid material that serves as a fuel source, oxygen, and a source of heat that can ignite the fuel source. On its own a solid cannot burn. A flame forms when heat combined with oxygen releases a flammable vapor from the solid. Ignition is generally the result of an accident involving a cigarette, cooking or an electrical malfunction.

WHAT TEST METHODS UNDERLIE TODAY'S FIRE STANDARDS FOR UPHOLSTERY?

Applicable flame resistance and/or smoke density test methods for vinyl-coated upholstery materials depend on a product's end use. As noted in test method CFFA-9, "Flame Resistance and Smoke Density," upholstery fabric used in contract furniture should meet NFPA 260, "Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture" and California Technical Bulletin 117-2013, "Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture." These procedures are based on a smoldering cigarette in contact with the crease at the seat and back in a miniature chair mock-up.

The main focus of these tests is the prevention of ignition of the underlying polyurethane foam cushioning, which can be a major contributor to the intensity of the heat and propagation of flame spread in a fire. Some vinyl compounds can meet NFPA 260 and TB 117-2013 without the addition of flame retardants – additives that disrupt this process by delaying ignition, slowing flame spread and removing the risk of deadly smoke inhalation. However, more stringent standards for flammability and/or smoke density may be required by local code requirements or by agreement between the producer and user.

HOW DOES FLAMMABILITY RESISTANCE WORK?

Flame resistant additives for specific fuel sources, such as furniture upholstery covering polyurethane foam, came into the market 50 years ago as the materials of construction for furniture evolved. Unlike in the past, most commercial buildings have furniture made of synthetic materials that ignite and burn faster than other constituents. In turn, the behavior of contemporary building fires and their smoke profiles raised cause for concern in terms of life safety. Flame resistant additives prevented the fuel source from contributing to the burning of other fabrics and building products in a fire and extend flashover time, which is that point when all of the combustible materials in a room or compartment (such as in transportation applications) reach their ignition temperatures at the same time. Without them, flashover can occur in three minutes or less; with them, that window can expand to a lifesaving 10-15 minutes.

AREN'T VINYL COATED FABRICS FIRE RESISTANT?

Upholstery covered with vinyl coated fabrics makes a positive contribution to building fire loads compared to some other products, because the chlorine composition of the vinyl resin gives the fabric a relatively high Limiting Oxygen Index, or the minimum concentration of oxygen, expressed as a percentage, needed to support combustion of a polymer such as vinyl. In fact, vinyl is the only plastic used for upholstery that is inherently flame resistant for its entire lifecycle. Although this characteristic helps to resist ignition and slow a fire's growth, by itself it may not be enough to meet the requirements of specific building and fire codes for flame resistance of specific end uses. These codes and standards stipulate burn rates just high enough that vinyl coated fabrics cannot reliably meet them without added flame resistant additives.

HOW IS FLAMMABILITY RESISTANCE ACHIEVED?

There are three possible approaches to preventing ignition and/or flame spread in a solid material, some of which may be combined in the product formulation:

- Make the fuel source non-combustible in the vapor phase.
- Form a char layer that insulates the fuel source and lowers the temperature.
- Quench the flame that does form by releasing water as the temperature rises, lowering the temperature and extinguishing the flame.

WHICH APPROACHES ARE USED IN VINYL COATED FABRICS?

The flame resistant additives that are commonly specified for vinyl coated fabrics include:

- Antimony trioxide inhibits combustible gases in the vapor phase. A small amount of antimony trioxide is all that is needed to meet most fire specifications.
- Phosphorus flame resistant additives are often used as a replacement or in addition to antimony. They also act in the vapor phase and as char formers, which both helps insulate the fuel from the flame and resists the flame.
- Intumescent flame resistant additives turn the burned surface into a char layer which insulates the material and the flame, reducing the heat and hindering the flame. There are several types of these, such as phosphorus and melamine based.
- Alumina trihydrate and magnesium hydroxide are endothermic/heat sink flame resistant additives, releasing water when they reach a certain temperature, which in turn reduces the temperature of the flame and extinguishes or retards it.
- Zinc-based flame resistant additives are sometimes used as fire retardants and as smoke suppressants and char formers.

ISN'T THERE A UNIFORM APPROACH TO ACHIEVING FLAMMABILITY PERFORMANCE?

No. The lack of a national standard defining flammability testing and acceptance criteria has led to a web of piecemeal state and local legislation governing chemical consumer products deemed unsafe by groups such as non-governmental organizations (NGOs). The resulting regulations may restrict or phase out the use of flame resistant chemicals in applications such as upholstery – or outright ban their use.[1] This is not sound science in any sense, as it involves no policymaking on the basis of understanding individual chemical properties, toxicology data or other empirical evidence related to environmental and human health. Banning, restricting or regulating entire chemical families precludes end users benefiting from the important attributes a given category, such as flame resistant additives, can provide. Safety is a priority for coated fabric manufacturers, so they have created products that can meet a wide range of regulations, as well as the needs of specifiers. Unfortunately, as a result of the lack of consensus on the subject, manufacturers are now more likely to eliminate flame resistant additives from their products altogether – a poor tradeoff in the absence of understanding the safe and effective use of fire resistant additives in upholstery applications.

[1] For a current list of state policies on flame resistant chemicals, go to https://www.saferstates.com

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