FIRE SAFETY WITH SPECIALTY COATINGS

by Cynthia Challenger
JCT CoatingsTech Contributing Writer

Fire protection has been recognized as a crucial part of public and commercial building design for decades. Following the collapse of the World Trade Center towers on September 11, 2001, increased attention has been focused on the need to ensure that adequate fire protection is incorporated and maintained in buildings where large numbers of people may be present. Thus, fire-resistant coatings, which have been available since the 1960s, have been receiving increased attention. These specialty coatings can help lengthen the time that structural materials can maintain their integrity under fire conditions.

Fireproofing is recognized to play a crucial role in establishing building safety and generally refers to the protection of the structural steel and other supporting parts in a building. Traditional fireproofing materials include concrete encasement, gypsum wallboard, and coatings categorized as Spray-Applied Fire-Resistive Materials (SFRCMs) that are typically composed of inorganic materials such as mineral wool, cement, and gypsum, and can vary in density. Intumescent fire-resistant coatings are newer fireproofing materials. They are paint-like coatings that are applied to structural steel members at a final thickness of 0.03 to 0.50 inches.

All of these fireproofing materials are designed to provide an insulating barrier between the heat from a fire and the structural steel. The barrier prevents the high temperatures within a fire from affecting the structural performance of the steel members. Because the intumescent coatings have paint-like properties, they are receiving increasing attention from architects and designers.

FIRE RETARDANT VS. FIRE RESISTANT

There are actually two types of "fire" coatings on the market. They are designed for use on different substrates and respond very differently when exposed to fire.

Fire-retardant paints are applied to combustible materials (wood, plastic, foam) and are designed to reduce the rate of flame spread. Typically, they are based on vinyl or vinyl acrylic resins. They look like paints and are formulated to be applied like paints (brush, roller, or spray). They do burn, can generate smoke, and do not have high temperature resistance.

The standard ASTM test for fire-retardant paints is ASTM E 84, which lasts for 15 minutes. The test evaluates flame spread and smoke development. Coatings that are meant to protect combustible substances are tested on Douglas-fir and are classified as either Class A, B, or C. The classification is determined via a comparison to red oak.

Many fire-retardant coatings are only rated for the ability to "not contribute" to a fire, i.e. they will not become a fuel source. Some do provide resistance in keeping the fire from getting to the substrate. Most create a soft char that will not keep plastics from melting and dripping into a fire. Some do not do a good job of preventing rapid heat transfer through metal. Smoke management is another, even more critical (and difficult to address) requirement. The smoke generation due to substrate/coating interaction will be different for different fire-retardant paint/substrate combinations and must also be designed into a robust coating system.

Fire-resistant coatings provide insulation to the substrate. Intumescent fire-resistant coatings work by expanding their volume from 10 to 75 times and generating an ash-like char. The extent of char will be dependent upon the material contained in the coating. The shape of the structural steel will affect expansion and char formation.

These coatings provide fire ratings (1, 2, 3, and 4 hours) depending on the coating thickness, steel shape, and steel mass. Adhesion, char integrity, and char growth are critical. The standard test for these materials for a cellulose fire is ASTM E 119 (UL 263, NFPA 251), which involves placement of the coated part in a furnace for 1–4 hours. IUL 1709 is the test used when it is necessary to simulate a hydrocarbon fire, which can reach very high temperatures very quickly (2,000°F within five minutes).

Fire-resistant coatings are applied in much greater thicknesses than fire-retardant coatings, and are either sprayed or troweled on. The thermolysis of these formulations is designed so that the coating hangs at a high film build. The level of film build varies from manufacturer to manufacturer and product to product.

BUILDING CODES AND APPROPRIATE APPLICATIONS

Fire protection requirements are established in various building codes. In the past, three model building codes were used in the U.S. for different regions of the country. In general, each state adopted the model code for the region in which it was located. Most smaller cities and towns, not having the resources to establish their own codes, also adopted them. Very large cities, however, like New York and Philadelphia, do have the resources to create their own codes. In some cases they developed their own codes by modifying the model code that applies to their region.

More recently, the International Code Council (ICC) has developed a set of building codes and there is a move throughout the U.S. to adopt them. The ICC has established the International Building Code (IBC), a model code used as the basis for building regulations promulgated and enforced by U.S. state and local jurisdictions. Those jurisdictions have the option of incorporating some or all of the code's provisions, but generally adopt most provisions.

The code describes, in a general sense, what standards a building should be built against, but does not specify what materials should be used. The generality allows architects, designers, and contractors to select the appropriate materials for different structures. Expected occupancy, height of the building, and other factors are considered when assigning the fireproofing requirements. Intumescent fire-resistant coatings are often specified by the architect where exposed structural steel is present. Typical examples include lobbies of hotels and high rise condominiums, convention centers, atriums, and remodeled warehouses and docks.

Most often, many different types and levels of fireproofing will be required for any one project because there will be different types and levels of substrates and exposures.

Suppliers of Fire Resistant/Retardant Coatings

Carbolite (division of RP4)
International Paint Protective Coatings (Akzo Nobel)
ASAI Manufacturing, a division of StanChem, Inc.
Isolatek International
PPG
Sherwin-Williams
Fire Research
The Murano Company
TERR Corporation (Thermal Product Research)
Flame Control Coatings, LLC
NoFire Technologies, Inc.

Source: Kissing, Netif & Gowerey

www.coatingstech.org
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Fire-resistant coatings provide insulation to the substrate. Intumescent fire-resistant coatings work by expanding their volume from 30 to 75 times and generating an ash-like char. The extent of char will be dependent upon the material contained in the coating. The shape of the structural steel will affect expansion and char formation.

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Source: Kissinger, Neff & Gower

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DEVELOPMENTS IN TESTING STANDARDS AND CODES

There are numerous standards that have been issued by independent and government agencies and laboratories in the U.S., such as ASTM, UL, ANSI, NFPA, and the U.S. Dept. of Defense. Additionally, there are many international standards such as IMO, ISO, and MPI. These standards are very detailed and specify performance criteria including: flame spread, resistance to ignition, rate of heat release, total heat release, smoke generation, toxic products of combustion, VOC, adhesion, resistance to water, salt water, chemicals, and gases, resistance to UV, durability, resistance to mold and bacteria, safety to the environment, and many more.

Some prep and application are some of the only formulations that include the intumescent material in the air as a protective barrier for a given amount of coating. Testing is conducted on the complete system, and the approved primer and topcoat formulations are then approved for use. Because application technique can affect performance, it is also defined by building codes.

Figure 2: Protection system. Most manufacturers require that contractors wishing to apply fireproofing coating products receive specific training and certification.

Testing and Application

Coatings must be tested on specific structures to determine the appropriate thickness. Most testing is conducted at Underwriters Laboratories (UL), an independent non-profit public safety certification organization, and each test is designed for a specific application. The architect's test design is utilized to generate thickness requirements which are dictated by building codes. The general contractor then places bids for the actual fireproofing work, which is completed by a certified contractor.

Testing at UL is not limited to the performance of the coating under certain simulated fire conditions. Coatings are also evaluated using the same tests after being subjected to numerous environmental conditions that could potentially affect the performance of the coating. These conditions include accelerated aging and elevated humidity for coatings intended for use within a structure; and accelerated aging, elevated humidity, carbon dioxide and sulfur dioxide air mixture, salt spray, ultraviolet light, freezing, and simulated rain for coatings intended for exterior exposure.

"The hope is that these fire Suppressant coatings will never actually be put into service," says Casey West, owner of Alba Manufacturing, a division of StanChem, Inc. "If they are, it could be many years after they have been installed. No matter how long the length of time is, the coatings still must perform as if they were installed the day they are needed."

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"Fireproofing needs to adhere under impact and fire conditions that deform steel members so that the coatings remain on the steel and provide the intended protection."

There remains, though, a lack of agreement among the players in the market as to what standards should include. According to one industry player, the market is still not sophisticated enough to develop a consensus as to what the physical performance guidelines should be.

The International Code Council (ICC) recently approved the 2007 code as the first comprehensive set of building code changes based on recommendations from the Commerce Department's National Institute of Standards and Technology (NIST). The recommendations were made on the findings of a three-year investigation to help the collapse of New York City's World Trade Center towers on September 11, 2001. The changes will be incorporated into the 2007 supplement to the ICC's International Building Code.

Several of the provisions refer to fire protective materials, both SFRMs and intumescent coatings. Specific items include increased bond strength of fireproofing materials (3-7 times), field installation and maintenance inspection requirements, and higher fire ratings.

FORMULATIONS

The key ingredients of fire-resistant coatings vary depending on the type of coating. In addition to a resin or binder, ablative coatings, or sacrificial coatings designed to reduce the rate of burn, usually contain fire-retardant chemicals such as aluminum trihydrate or antimony oxide. Intumescent coatings contain a resin and approximately 15% other ingredients. The three key active components are the promoter or catalyst (typically a phosphorus acid, such as ammonium polyphosphate), a char former (often pentaerythritol), and a blowing agent (usually a melamine derivative).

Fire-resistant coatings contain only a fraction of the amount of some of the ingredients found in fire-resistant paints. It is difficult to maintain traditional paint characteristics when adding larger quantities of flame-retardant chemicals into a formulation. In particular, if too much retardant, generally a phosphorus, is used, blending and spraying equipment can become clogged. The use of activated carbon particles is being investigated, but this material is a challenge to keep in suspension.

In general, intumescent coatings differ in how the fire-resistant chemical is formulated to create a clearer and more consistent finish. All of the ingredients are important because they interact to create something that is capable of achieving the desired overall performance.

For fire-resistant coatings, selecting the appropriate fire retardant, group for formulation and application is critical. "The resin is directly related to adhesion ability, and therefore to durability," says Rippe. "In addition, different resins react at different temperatures, and the resin must bond to the substrate to prevent chalking."

There are two main types of resins used in these intumescent coatings—vinyl acrylics and epoxies. Water-based (latex) vinyl acrylic formulations are typically used for interior applications. Because the ingredients have some water solubility, the water resistance and general exterior durability of these formulations is affected. Solvent-based vinyl resins and 100% solids epoxies find use in external applications where weathering can occur. Epoxy in particular are finding use in offshore oil platforms where there is a potential for hydrocarbon fires.
"Different substrates require the use of different kinds of coatings," stresses Bob Zielenki, technical sales and marketing director for Flame Control Coatings, LLC.

For combustible surfaces like wood and plastic, the coating needs to be able to reduce the surface burning characteristics of the underlying substrate. For substrates like metal, masonry, and drywall, which are effectively non-combustible in nature, the coatings need to either limit the combustibility of the substrate or limit the heat that is transferred to the substrate from the fire.

For exposed structural steel, however, intumescent coatings are a more attractive alternative because they provide a textured paint-like appearance and are more aesthetically appealing. "Even though intumescent coatings are more expensive than traditional fireproofing materials, they broaden the architect’s options for artistic expression," states Alan Rippe, director of International Industrial Fireproofing with Carboline. He adds that for some industries—such as computer chip manufacturing—where a dust-free environment is critical, fire-resistant coatings are more much more appropriate than cementitious materials.

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"Testing at UL is not limited to the performance of the coating under certain simulated fire conditions. Coatings are also evaluated using the same tests after being subjected to numerous environmental conditions that could potentially affect the performance of the coating. These conditions include accelerated aging and elevated humidity for coatings intended for use within a structure; and accelerated aging, elevated humidity, carbon dioxide and sulfur dioxide air mixture, salt spray, ultraviolet light, freezing, and simulated rain for coatings intended for outside exposure."

"The hope is that these fire-suppressant coatings will never actually be put into service," says Casey West, owner of Albex Manufacturing, a division of StanChem, Inc. "If they are, it could be many years after they have been installed. No matter how long in length of time is, the coatings still must perform as if they were installed the day they are needed."

Surface preparation and application are some of the non-formulation related factors affecting performance. Primers are generally required, as well as a protective barrier for a given coating system. Testing is conducted on the complete system, and only approved primer and topcoat formulations are then approved for use.

Because application technique can affect performance, it also can ultimately affect the performance of the coating, as "adhesion is absolutely crucial to proper performance," states Figone. To maintain consistency of this important aspect of the protection process, most manufacturers require that contractors wishing to apply fireproofing coating products receive specific training and certification.

Developments in Testing Standards and Codes

There are numerous standards that have been issued by independent and government agencies and laboratories in the U.S., such as ASTM, UL, ANSI, NFPA, and the U.S. Dept. of Defense. Additionally, there are many international standards such as IMO, ISO, and MPI. "These standards are very detailed and specify performance criteria including: flame spread, resistance to ignition; rate of heat release; total heat release; smoke generation; toxic products of combustion; VOC; adhesion; resistance to water, salt water, chemicals, and gases; resistance to UV; durability; resistance to mold and bacteria; safety to the environment; and manual handling," says Sam Gottfried, chief technical officer with NoFire Technologies.

Despite the existence of so many standards, after the 9-11 tragedy several groups conducted extensive testing and initiated programs to develop more extensive standards for fireproofing materials. Included in these efforts are SFRMs and intumescent coatings.

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Formulations

The key ingredients of fire-resistant coatings vary depending on the type of coating. In addition to a resin or binder, additive coatings, or sacrificial coatings designed to re-distribute the rate of burn, usually contain fire-resistant chemicals such as aluminum trihydrate or antimony oxide. Intumescent coatings contain a resin and approximately 15% other ingredients. The three key active components are the promotor or catalyst (typically a phosphorous or sulfur pentaphosphate), a char former (often pentaxanthol), and a blowing agent (usually a melamine derivative).

Fire-resistant coatings contain only a fraction of the amount of some of the ingredients found in fire-resistant coatings. It is difficult to maintain traditional paint aesthetics when adding larger quantities of flame retardant chemicals into a formulation. In particular, if too much retardant is used, a phosphorous, is used, blending and spraying equipment can become clogged. The use of activated carbon fibers is being investigated, but this material is a challenge to keep in suspension. In general, intumescent coatings do not maintain the traditional fire retardant chemical is formulated to create a char layer and char integrity. All of the ingredients are important because they interact with one another to achieve the desired overall performance.

For fire-resistant coatings, selecting the appropriate material is a given formulation and application is critical. "The resin is directly related to adhesion ability and, therefore to durability," says Rippe. "In addition, different resins react at different temperatures, and the red resin must be so that charring is produced at the proper time."

There are two main types of resins used in these intumescent materials—vinyl acrylate and epoxies. Waterborne (latex) vinyl acrylic formulations are typically used for interior applications. Because the ingredients have some water solubility, the water resistance and general exterior durability of these formulations is affected. Solvent-based vinyl resins and 100% solids epoxies find use in external applications where weathering can occur. Epoxies in particular are finding use in offshore oil and gas platforms where there is a potential for hydrocarbon fires.
and weathering can be a significant issue.

Formulations of each type of coating may also vary according to the substrate on which they are intended to be used. "Some coatings are designed to work on multiple substrates, while others may require changes," says West.

The challenge today is to create higher performing flame retardant and resistant coatings that behave more like traditional paint with regard to appearance and application. "There are three main properties that need to be addressed," says Paul Greig, a technical manager in PPG’s Protective and Marine Coatings business unit. "Fire-suppressant coatings must be able to offer the maximum level of performance with regard to fire protection and durability, and be easy to apply. All three of these characteristics need to be optimized.

Currently, the market is looking for interior fire-protection coatings that are single component products that can be applied with a brush, roller, or can be sprayed on, and that have the appearance of regular paint. Newer lacquer paints are coming closer to meeting these expectations. Exterior formulations, however, tend to be much thicker and often are two-component formulations that provide a more textured appearance. Intensive research efforts within the industry are focused on developing structural coatings that provide the necessary durability for exterior applications is another area targeted by coatings manufacturers.

**REGULATORY ISSUES**

Regulations covering VOCs do apply to fire-protection coatings, but they have not, up to this point, affected the ability of coatings manufacturers to formulate solvent-based coatings. "The regulations are performance driven and are not affecting our ability to develop new formulations," says Rippe. Rick Jones, vice president of The ChemQuest Group, Inc., a Cincinnati-based coatings consulting firm, adds that the VOC regulations are based on best available technology and recognize that the performance of the coatings is a critical safety issue. Even so, it can be expected that VOC limits will be lowered as technology becomes available to provide the necessary level of fire protection at lower VOC levels.

Many manufacturers are already shifting to water-based formulations and are working to overcome some difficulties presented by the use of water as the carrier. "It can be a challenge to incorporate the amount of flame retardants necessary to achieve desired ratings into water-based (or very low VOC) systems and still maintain the physical properties required for the coating," notes Zielinski.

For PPG, a greater challenge in developing new formulations of fire-protection coatings relates to the numerous different registration lists that must be complied with currently. The U.S., Canada, Europe, Japan, Korea, China, and the Philippines all have specific regulatory requirements regarding raw materials. "When developing new formulations, it is a real challenge to ensure that all materials meet the various requirements of these lists from different countries and regions of the world," explains Greig.

**MARKET DYNAMICS**

In the U.S., the market for fire-resistant and fire-resistant coatings (as defined by ASTM tests E 84 and E 199) has reached 1.5-2 million gallons and a value of $60 million, according to consulting firm Kusumgar, Neff & Crowley. A modest annual growth rate of 5% reflects a growing interest in these types of coatings for fire protection.

As mentioned, while these coatings have always been recognized as important, the circumstances surrounding the 9-11 terrorist attack brought protective fire coatings back into the forefront and raised their profile. "We are seeing the development of coatings for blast mitigation in addition to force mitigation (wind and seismic disturbances), and the use of fireproofing coatings is increasing in this activity," says Jones. "The polyureas used for blast mitigation offer different functionality, of course, but the drivers behind the growth and development of these materials are carrying over to protective coatings as well."

An overall trend toward increased multi-functionality in coatings should also have a positive effect on the fire-suppressant coatings sector. "The market is demanding additional functionality above and beyond aesthetic appeal and protective properties," Jones explains. Examples include cool roof, self-cleaning, and biocidal coatings. "It is not a big leap to suggest that fire protection capability will eventually be incorporated into a broader set of coatings. Of course, ultimately more expanded use will be determined by economics. "Whether or not the technology can be achieved at an appropriate price point.

A recent trend in the U.S. has been the emergence of greater numbers of products being introduced through the Internet that have not been properly tested, according to Zielinski. "Only about 50% of building officials properly evaluate the qualifications of the products being proposed for a particular building, which makes sure that the intent of the building codes is properly enforced," he notes.

Entry into the fire-resistant coatings market, however, is not easy. According to West, the technology for producing fire-resistant coatings is not easy to develop or duplicate. In addition, the products must be fire tested at a high cost. Therefore, it is difficult for companies, especially those in low-cost regions of the world, to enter the market and be competitive.

Emerging markets such as China, India, and Eastern Europe actually present a great opportunity for producers of fireproofing coatings. All of the leading producers in the U.S. and Europe have a presence in at least one or two of these regions, either through licensing agreements, partnerships/alliances, or joint ventures. As part of the world’s increase in sophistication and population density, fire regulations in those areas will become more stringent. The Chinese, for example, want a company is a major player in this sector of the coatings industry, they need to have a presence in these developing markets." Rippe asserts.

Changing building codes in these developing regions will provide additional mechanisms for growth. In many of the emerging markets, building codes are not advanced and often are very simplified. "As building codes in these emerging regions become more sophisticated, there will be a great opportunity to provide fire-protective coatings," West states.

Building codes and codes are also changing in the U.S. Fire ratings are increasing for taller buildings, and lower smoke tolerances are being set for interior coatings. "We see the codes aggressively changing," says Richard Barone, VP-Marketing for TFP2. "Everything from NYC, having fire retardant electrolytescience coatings in all stairwells, to mining op-erations requiring significantly more robust protection of mine seals and equipment, to professional racing mandating fire safety non-par with space shuttle needs."

Use of a wider array of substrates may also provide opportunities. Fire-retardant polyurethane (PU) foam coatings are an emerging market for us," says Barone. "Projects show that spray polyurethane foam insulation is going to grow by leaps and bounds over the next several years. The problem with PU spray foam insulation is flammability and smoke. Therefore, fireprotective coatings are ideal for this substrate. The replacement of standard building materials, including steel, with strong lightweight, but combustible materials, such as composites, is another example of a situation that requires use of a fire-suppressant coating, according to Gottfried. These new applications require additional performance features beyond fire protection.

There is also a growing awareness of the fire protection benefits of fire retardant and fire-resistant coatings. "These materials are becoming a more viable option. They can provide real fire protection if specified and in addition have the other advantages of intumescent coatings," says Rippe. According to Barone, many companies and industries are defining their own internal, more aggressive standards for these coatings.

Even though they are significantly more expensive than other alternatives, the use of intumescent coatings can result in space savings that equate to overall cost savings in some projects. In addition, they provide the architectural finish with more freedom in terms of design.

**PRODUCT HIGHLIGHTS**

Albi, a division of SunChem, Inc., manufactures three fire-resistive coatings that are sold under the Albi Clad trade name. This range includes an interior, waterborne UL-product; an exterior solvent-based coating; and an interior water-based coating specifically designed for wood, concrete construction identified on site, and historical renovation projects. A fourth product consists of comprised mineral fiberboard fireproofing material. Its Albi Clad fire product designated for wood is the newest product and was developed in response to growing demand for one- and two-hour rated protective coatings for wood substrates, according to West. It is also applicable for foam.

The company also offers an extensive line of fire-retardant coatings sold under the Albi Cote trade name. Many are designed for plastic and other unique substrates. Two of its biggest products include a water-based, Class A rated coating and a fire resistant topcoat that doesn’t burn and is mostly used over the Class A rated product.

Albi has its own fire test facility with new furnaces and has developed laboratories specifically for its fire-protective coatings business.

We are always working on new
REGULATORY ISSUES

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Entry into the fire-resistant coatings market, however, is not easy. According to West, the technology for producing fire-resistant coatings is not easy to develop or duplicate. In addition, the products must be fire tested at a high cost, therefore, it is difficult for companies, especially those in low-cost regions of the world, to enter the market and be competitive.

Emerging markets such as China, India, and Eastern Europe actually present a great opportunity for producers of fireproofing coatings. All of the leading producers in the U.S. and Europe have a presence in at least one or two of these regions. For example, through licensing agreements, partnerships/alliances, or joint ventures. As parts of the world increase in sophistication and population density, fire regulations in those areas will become more stringent. Hence the need for fire-resistant and fire-resistant coatings.

Changing building codes in these developing regions will provide additional mechanisms for growth. In many of the emerging economies, the building codes are not advanced and are often very simplified. "As building codes in these emerging regions become more sophisticated, there will be a great opportunity to provide fire-resistant coatings," West states.

Building codes are also changing in the U.S. Fire ratings are increasing for taller buildings, and lower smoke tolerances are being set for interior coatings. "We see the codes aggressively changing," says Richard Barone, VP-Marketing for TPF. "Everything from NYC, having fire-retardant electromerise coatings in all stairwells, to mining operations requiring significantly more robust protection of mine shafts and equipment, to professional racing mandating fire safety on par with space shuttle needs.

Use of a wider array of substrates may also provide opportunities. Fire-retardant polyurethane (PU) foam coatings are an emerging market for us," says Barone. "Projections show that spray polyurethane foam insulation is going to grow by leaps and bounds over the next several years. The problem with PU spray foam insulation is flammability and smoke. Therefore, fire-protective coatings are ideal for this substrate. The replacement of standard building materials, including steel, with strong lightweight, but combustible materials such as composites, is another example of a situation that requires use of a fire-suppressant coating, according to Gottfried. These new applications require additional performance features beyond fire protection.

There is also a growing awareness of the fire risk to all fire retardant and fire-resistant coatings. These materials are becoming a more viable option. They can provide real fire protection in addition to the other advantages of intumescent coatings," says Rippel underscores. According to Barone, many companies and industries are defining their own internal, more agressive standards for these coatings. Even though they are significantly more expensive than other alternatives, the use of intumescent coatings can result in space savings that equate to overall cost savings in some projects. In addition, they provide the architect with more freedom in terms of design.

Product Highlights

Albi, a division of SunChem, Inc., manufactures three fire-resistive coatings that are sold under the Albi Clad trade name. The product range includes an interior, water-based UL listed product; an exterior solvent-based coating; and an interior water-based coating specifically designed for wood, defective construction identified on site, and historical renovation projects. A fourth product consists of compressed mineral fiberboard fireproofing material. Its Albi Clad FP product is designed for wood is the newest product and was developed in response to growing demand for one- and two-hour rated protective coatings for wood substrates, according to West. It is also applicable for foam.

The company also offers an extensive line of fire-retardant coatings sold under the Albi Cote trade name. Many are designed for plastic and other unique substrates. Two of its biggest products include a water-based, Class A rated coating and a fire inert topcoat that doesn’t burn and is mostly used over the Class A rated product.

Albi has its own fire test facility with two furnaces and has developed laboratories specifically for its fire-protective coatings business. We are always working on new products that will be more cost effective and faster, with less maintenance, or more fire-resistant, or more durable. We also have plans to develop new products, including a new coating for concrete that will be more fire-resistant and more cost effective.

Interior Walls—Photo courtesy of American Cutlery.
Carboline has acquired two companies with the goal of expanding its product line. "We are committed to this industry and will continue to grow both organically and through acquisitions where they are appropriate," says Rippe. PPG offers a wide range of protective coatings products. Its Polycarb™ series includes a 100% solids, two-component epoxy-based product that can be applied using a variety of graphics equipment. Cleanup of the equipment simply involves rinsing with water. The company is currently developing the next generation of this epoxy coating.

SteelGuard™ is a vinyl, solvent-based thin film widely used in Europe. PPG recently received US approval listings for this product. A waterborne (lakes) version that provides comparable fire ratings at thinner films is in development and testing phase.

"We are dedicated to growing this business," states Lyman. In September 2006, PPG formed the Protective and Marine Coatings business by merging its high performance coatings units and refineries business. Since then, PPG Protective and Marine Coatings has purchased Champion Coatings. With the acquisitions, the business unit now has worldwide capabilities in the U.S. and Europe and manufacturing sites around the world.

Flame Control Coatings offers a line of fire-retardant paints. Recently, the company launched a $50-50 foam base product which serves as an approved "ignition burner" for Spray Polyurethane Foam insulation (SPF). "As far as we are aware, our product is one of only two to pass the required tests," says Zielinski. Flame Control has also expanded its plant and staff and is looking at several acquisitions.

NoFire product line includes intumescent coatings, fire-retardant wraps, and fire-retardant systems for nuclear, military, maritime, residential, commercial, industrial, and transportation applications. "The primary goal of the company is to increase fire performance and efficiency, allowing for thinner, more economic coatings for commercial and industrial applications where cost is a determining factor," says Gottfried. Recently, the company introduced the third generation of its NoFire A-15 fire resistant products for military, marine, and residential applications. NoFire LP is designed for residential and small business applications and provides all the features of the NoFire standard products but at a more attractive price.

The NoFire product is a liquid fire retardant for use as an automotive material. Similar to paint, on many different kinds of substrates to render them fire and heat resistant. The product can be manufactured in various liquid forms, and specifically adapted for the particular substrate, application, and degree of protection required, or as a coated textile product, typically a woven fiberglass material, coated with the NoFire liquid product.

According to Gottfried, beginning in the fall of 2007, the company will be launching new products specifically designed to meet commercial and industrial requirements for high speed manufacturing applications that will also provide higher fire suppression than currently available. NoFire is also currently in discussions for partnerships, including additional facilities. TPI3 has nine coatings that have been tested over, and passed on, metal, fiberglass, wood, PU insulating foam, plywood, PE plastic, PCC plastic, and other customerspecific substrates. "Our FIRESHIELD ULTRA nonflammable and TEAPROTEX fire extinguishing coatings overcome resin behavior in a variety of proprietary and patented ways," says Barton of the company. As a "green-oriented" company, TPI3 focuses "on how available components and raw materials can be formulated in the most environmentally friendly and performance effective way."

R&D efforts have led to the development of several new products. In 2007, the company presented a new flame retardant for steel. This new product will be followed up in 2008 with a bio-based coating that is designed to be applied directly on homes in the path of wildfires to prevent fire damage. In addition, TPI3 is currently looking to expand on the West Coast.

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