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A new intumescent coatings system from Sherwin-Williams pushes the boundaries of time turn-around without compromise. Here, **Carl Burrell**, Head of the fire & insulation laboratory at Sherwin-Williams, looks at the development and application of the new cutting-edge technology

Pushing the boundaries

Planning for modern construction projects must factor in the time steelwork spends in fabrication shops as protective coatings are applied.

WHY COAT STEEL?

The application of intumescent coatings can be a slow process for fabricators, adding time to any construction project. However, intumescent coatings are a crucial part of any structural steel development, providing vital passive fire protection. Appearing to all intents and purposes as an ordinary coating, with a thicker film, these coatings demonstrate unique properties.

A series of chemical reactions swell the coating to many times the original thickness to provide an insulating char or foam. In a standard cellulosic fire (when the fuels are wood, paper or plastic) an average piece of unprotected steel hits 500°C in just 13min. Protected steel, however, can take as long as 120min to reach this critical failure point.

Intumescent coatings are not new technology and were first developed in 1936. Many types are available, from thick film, epoxy-based coatings, which are tough and durable, suitable for protecting against the severity of hydrocarbon fires, to thin film, solvent- or water-based coatings, mainly used to protect against cellulosic fire conditions.

The coating process is, therefore, a vital one and is usually the responsibility of fabrication shops. The application process is the same for any such coating. Fabricated steel is blasted then primed then, following the primer application, the intumescent coating is applied. Subsequent coats are applied until the required film thickness is achieved.

Depending on the nature of the project being applied, there may be a top coat applied to the intumescent coating to provide external weather resistance.

Due to the complex nature of many modern construction projects, intumescent coatings have never played a more important role, particularly with the construction industry booming.

For instance, the Construction Products Association's latest construction trade survey revealed that 44% of contractors reported that construction output rose in the last quarter of 2014, compared to 2013.

TIME TO COAT

Solvent-based coatings can take up to a week to reach full specified dry film thickness and can take a significant period of time before they can be exposed to the weather. This is a noteworthy delay to be factored into any project.

Once coated, the steel is susceptible to mechanical damage at this stage, when being transported both in the shop and being erected on site.

It has long been recognised by the industry that it would be of real benefit to the fabrication companies and their customers if this process could somehow be accelerated.

As a result, Sherwin-Williams' FIRETEX FX6000 was developed to meet identified customer needs, in particular through improving productivity in a fabrication shop by reducing the amount of time taken to apply a full fire protection system.

THE DEVELOPMENT OF FIRETEX FX6000

The process for fabrication companies with traditional products and with the FIRETEX FX6000 product is very similar, up to a point. The basic blasting, priming and coating is undertaken as with any product.

However, FX6000 pushes the boundaries with an extremely fast cure and with this new advantage, multiple coats of product can be applied in one day.

Traditional solvent-based coatings will dry based upon solvent evaporation from the applied coating. When these materials are applied at higher thicknesses – for instance to ensure increased time period fire protection – drying and handling times are significantly increased.

This new technology dries as a result of a chemical cross-link reaction rather than solvent evaporation. This chemical reaction proceeds at a rapid rate, which is what provides the FX6000 with its unique drying and handling properties, enabling multiple coats to be applied in a day.

The fast cure means that application can be completed in a

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Carl also manages the global approval programmes for these products and is also heavily involved in the field of thermal insulation, especially working in the area of cryogenic spill protection.

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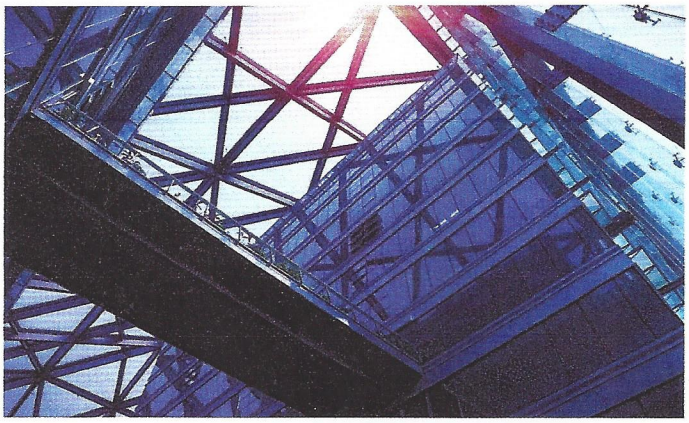

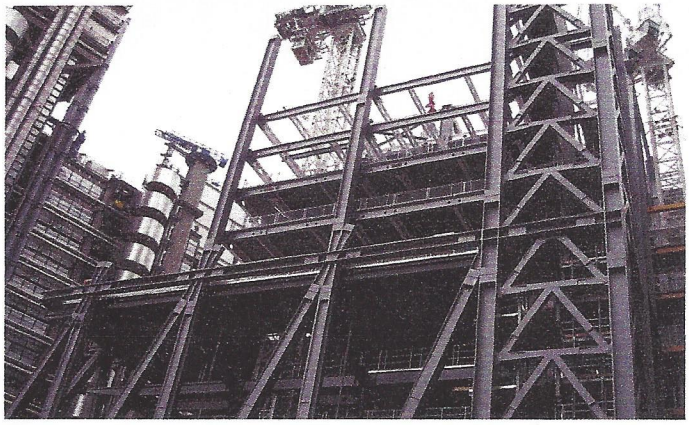

much reduced time period and the completed steel can be put into outdoor storage sooner, meaning that valuable shop space is not taken up and that production can carry on.

For many modern steel structural projects, this is a huge benefit, especially with longer periods of fire protection being increasingly required.

Curing to a very hard, durable film, the added benefit of this breakthrough means there is more resistance to mechanical damage, with less time and money required to repair any damage that may be done to the fire protection, again reducing the costs associated with the total project.

The fast cure of the product means there are win-wins all round. Not only can a project be completed on the production line more quickly, with higher productivity rates, it means the building owners can be assured of a faster turn-around and installation.

With curing at lower temperatures than are required for adequate drying of solvent-based coatings in a fabrication paint shop, even heating costs can potentially be reduced.

As a very high volume solids product, FX6000 also offers a significant reduction in volatile organic compounds (VOCs) generated when the product is cured. This can offer a benefit to a steel fabricator and painter in terms of being beneficial for the solvent emissions directive.

This technology is starting to make new inroads into turn-around time of projects as modern steel structures built in major towns and cities in the UK and worldwide, become more complex and the demands of project owners become more challenging.

Intumescent coatings – the journey towards a harmonised European Norm and ultimately mandatory CE Marking

Trevor Fielding, BCF

The European Intumescent Coatings industry has undergone some very significant changes in recent years. This is thanks to the efforts of several organisations and, more especially, some very experienced and dedicated individuals from the industry, that have driven the progress through the establishment of standards, key documents and supporting activities. Fifteen years ago this sector of the coating industry was regularly criticised for the absence of good performance standards and concerns over product quality and application issues.

Recent efforts have culminated in the successful publication of BS EN 16623:2015 'Paints and varnishes – Reactive coatings for fire protection of metallic substrates – Definitions, requirements, characteristics and marking'. This may be regarded as a voluntary product standard for intumescent coatings and which will now be used as the basis for work on a future harmonised European Norm (hEN). Once such a hEN is established, then intumescent coatings would meet the requirements of the Construction Products Regulations with respect to the need for mandatory CE marking of these coatings; a path that is welcomed by the major intumescent coating manufacturers across Europe. This would ensure that the products supplied would need to meet minimum performance standards and it would result in a level playing field across the European Union for the industry. The creation of a hEN still requires several more years of work within the appropriate standards committees and other working groups. This means that mandatory CE marking is still at least three years away but already the intumescent coatings industry is being recognised and commended for its proactive approach.

Additional progress has been made, for example, with respect to fire testing and assessment standards, through the publication of parts 6 & 8 of BS EN13381:2013 'Test methods for determining the contribution to the fire resistance of structural members' and the forthcoming publication of parts 9 & 10. There is also a coatings industry commitment to become more actively involved with the accreditation and certification process. This is to ensure that the appropriate approach is taken with regard to the testing of intumescent coatings and that the competency of all certification bodies involved in the sector is assured. Finally, in conjunction with other key fire protection organisations, such as the EAPFP and EAIPC, the CEPE Intumescent Coatings Technical Committee has published a 'Best Practice' guide for applicators, which will greatly assist users of these coatings, helping them achieve optimum product performance.

The intumescent coatings industry has come a long way and although there is plenty of work still to do on the journey towards a harmonised European Norm, this is already an excellent example of what can be done when a group of industry experts work together to drive for improvements in working practices and standardisation.

Jonathan Dyson looks into the growing demand for flame retardant coatings in both the USA and Europe

Fire retardant coating innovation strong in the USA

Increased demand for fire-retardant paints and coatings, and tighter regulations around the use of certain flame-retardant chemicals, is leading to a growing range of innovations in this sector. A wide range of such developments is emerging in the USA in particular, although European research is also ongoing.

A report published in 2014 by the market research firm The Freedonia Group observed that the use of flame retardants in the USA has increased significantly over the past few decades, with demand forecast to grow to more than US$1.6bn by 2016, representing annual growth of 6% between 2012 and 2016.

Steve Sides, Vice President, Science, Technology & Environmental Policy at the American Coatings Association (ACA), suggests that the tightening of USA regulations on chemicals, as well as infrastructure protection, is helping drive a growing range of innovations in fire-retardant coatings in America. Sides explains that the introduction of new or already existing chemicals in the USA is regulated by the Toxic Substances Control Act (TSCA), which is administered by the United States Environmental Protection Agency (EPA).

MORE CHEMICALS REVIEW

In October 2014, the EPA amended the list of substances in its TSCA work plan for chemical assessments, adding 23 chemicals requiring further review. These included chemicals used in fire-retardant products, such as decabromodiphenyl ether (decaBDE) used as a flame retardant resins and adhesives, linked to thyroid, liver, neurological and reproductive/developmental problems.

Sides adds that increasingly strict standards related to infrastructure protection are also driving innovations in the USA coatings industry, in products, such as fire-retardant coatings, as coating manufacturers look to provide the required performance levels. An example is the USA National Fire Protection Association (NFPA) codes and standards including NFPA 703, which provides criteria for defining and identifying fire retardant treated wood and fire retardant-coated building materials.

One leading company is Firefree Coatings, based in San Rafael, California, which produces a range of fire retardant and fire resistant water-based coatings that can withstand temperatures of up to 2000°F (1093°C) for an extended time, according to the company.

John Simontacchi, CEO and founder of Firefree Coatings, explained to *PPCJ* that the coatings it produces are intumescent, swelling through heat exposure. "When heat is applied to the coating material, at 177°C (350°F) the coating will expand and rise, much like a cake rising in the oven," he says. "When the coating reaches full expansion, a protective char is formed that continues to provide fire protection to the coated material."

Firefree's products include its FF88 coating, which according to the company, has been tested successfully on a range of material substrates, including gypsum board, wood, lath and plaster, concrete, concrete block/brick, thin gauge metal, embossed tin, polyurethane and other foam types, fibreglass and carbon fibre, as well as other composite and foam/composite type materials.

Another key player is Firetect, based in Valencia, southern California, which manufactures flame retardant paints, coatings and saturants for decorative interior materials, such as fabrics, wood, hay, straw, cardboard, foam and foliage.

Its products include WT-102, a non-hazardous, non-toxic, non-carcinogenic, Class A (the highest protection under NFPA codes), interior latex-based flame retardant intumescent coating, which, according to the company, can be applied on wood and other decorative surfaces.

Further information:
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Kathy Newman, CEO at Firetect, says that the company is currently working on new formulations that can help combat all types of fire, including wild fires and oil rig fires, while ensuring that such products are produced in a sustainable manner and also offer 'superb aesthetics and durability'.

FIRE GEL COATING

Fire gels are also being increasingly used. One such product is Barricade Fire Gel, from Barricade International, based in Hobe Sound, Florida.

John Bartlett, President of Barricade, explains that Barricade's fire gel is a temporary spray-on fire-resistant coating that can be sprayed on to a structure threatened by wildfire. He notes that the product is designed to prevent structures from igniting during a wildfire by holding water on the surface of the structure, utilising super-absorbent polymer technology.

"Barricade can be easily applied by homeowners and firefighters and has been credited with saving hundreds of houses from destruction," he says.

Bartlett adds that Barricade Fire Gel is non-toxic and environmentally friendly, and has received a Champion Award from the US Environmental Protection Agency (EPA) for the use of safer surfactants in the formulation.

Another USA-made fire gel on the market is Thermo-Gel, from San Diego-based Fire Etc. The product is a gel concentrate, which, when added to water, transforms it into a fire-preventing and heat-absorbing Class A fire-retardant gel, according to Fire Etc. The company says that it is "highly effective in fighting active fires, wild land fires, prescribed burns, urban interface fires, aviation applications and in the protection of all types of structures from homes to commercial and industrial investments".

EUROPEAN INNOVATION

Of course, the USA is not the only region with innovation in developing fire-retardant paints and coatings. European innovators are also making progress. Projects include the European Union (EU)-funded Reactafire project, launched in January 2014, which aims to develop a unique advanced coating system using innovative materials that will accelerate the charring of wood and help to improve the structural fire protection of timber. The project received funding from the EU's Seventh Framework Programme for research.

A note from the project consortium, which includes the European paints and coatings companies Fire Protection Coatings Limited (UK) – lead co-ordinator; and JW Ostendorf (Germany) – explains that the project comprises two innovative steps: accelerating char formation and combining this technology with the latest advances in geo-polymer coatings technology.

"The Reactafire product will be unique by offering structural fire protection for timber", it says, adding that the product will improve the structural fire protection beyond a resistance of 60min. It would also reduce the risk of fire within a timber frame building by reducing the need for non-combustible boards to provide protection, especially during construction of the building. As well, it would reduce the likelihood and severity of fires in cavities during and after completion.

The project was discussed at a European Commission review meeting in Brussels in October 2014, where it received positive feedback, according to the project consortium.

Other EU-funded projects designed to drive innovations in flame-retardant paints and coatings in Europe include: 'New Generation High-performance Fire Retardant Epoxy Nanocomposites: Structure-Property Relationship' (NEWEPOXY); 'Demonstration of innovative fire protection coatings for steel structures' (STEELPROST); 'New generation of eco-benign multifunctional layered double hydroxide (LDH)-based fire retardant and nanocomposites' (ECOFIRE-NANO); and 'Development of safe and eco-friendly flame retardant materials based on CNT [carbon nanotube] co-additives for commodity polymers' (DEROCA).

Several leading European paints and coatings companies have well-established fire-retardant product ranges. One such company is Dutch multinational AkzoNobel, whose products include its Interchar range of intumescent coatings designed to cater for architectural applications in the built environment, including internal and externally exposed structural steelwork. It also produces its Chartek intumescent coatings designed to protect against hydrocarbon and jet fires for industrial and offshore installations, including structural steel, vessels, pipework, blast walls and decks.

Other leading European suppliers of fire-retardant paints and coatings include Norwegian multinational Jotun, whose product portfolio includes Steelmaster 60WB, a waterborne acrylic thin film intumescent coating; UK-based Sherwin-Williams' protective & marine coatings, which offers a wide-range of fire-retardant products, including FIRETEX FX5120, a single-component water-based thin-film intumescent fire protection coating for use on interior exposed structural steel substrates; and Danish multinational Hempel, whose Hempacore range of intumescent fire protection coatings are designed to insulate structural steel to ensure buildings, such as sports stadia, airports and skyscrapers remain sound for longer.