



On the OUTSIDE

Innovative architectural designs and demand for increased functionality are driving new developments in architectural coatings, with energy efficiency and self-cleaning being added to requirements such as anti-graffiti.



PPG's PSX700 is used on many of London's highway structures

The market for architectural coatings in Europe and the Middle East is currently estimated at £13 billion.

As more functionality is demanded, the use of smart coatings in particular is expected to expand rapidly. Analysts NanoMarkets say the construction industry will be spending £2.4 billion on smart surface products by 2020. About one-third of that will be smart solar surfaces, including both photovoltaic panels integrated into roofs and windows, and self-cleaning solar panels that can increase their efficiency by ridding themselves of dust and dirt. Self-cleaning walls, windows and other surfaces are also expected to take off.

LOCAL COLOUR

Architectural design innovations are also forcing exterior coatings to catch up with interior products with fashionable colour palettes as well as purely practical applications, leading to some interesting research projects.

AkzoNobel and architecture firm OMA are currently partnering in global research into the link between colour and economic development. The study focuses on the extent to which making an area more visually attractive can influence economic growth. AkzoNobel's CEO Ton Büchner says: "By the 2050s, more than 75 percent of the world's population will live in cities. Given that 60 percent of our products are in the Buildings and Infrastructure and Transportation end-user segments, AkzoNobel has an important influence on the process of urban transformation that's currently taking place. It's therefore our intention to use our expertise to make city life more energizing, inspiring and vibrant for people across the world."

SAVE YOUR ENERGY

More immediately, the role of coatings in energy consumption is becoming increasingly important. The International Energy Agency predicts that energy use in America will increase 14 per cent by 2035, with fossil fuels accounting for nearly 80 per cent of that. In the EU, although energy consumption has been falling (in 2013 it was down by more than 9% from its

2006 peak), Europe remains heavily dependent on fuel imports. The recent drop in consumption reflects economic troubles in the Eurozone, but it also shows that efforts to cut energy use and improve efficiency are having an impact.

A major project in Moscow shows what can be done. In 2008 the Russian government allocated a significant portion of its budget to the modernisation of housing stock, including use of coatings to reduce energy waste. In Moscow the authorities planned to demolish all of their five storey prefabricated apartment blocks (some 25% of the developed area of the city) as 'beyond economic repair'. External Thermal Insulation Composite Systems (ETICS) systems have now been installed in many of the replacement buildings, with dramatic reductions in energy waste.

MANUFACTURERS CHALLENGE

PPG, which took over the North American architectural coatings business of AkzoNobel in 2013, are focusing product research on energy efficiency.

Chairman and CEO Charles Bunch says "While customers will continue to seek products that ensure safety and security, provide protection, and enhance functionality and aesthetics, the biggest challenges they face will be related to energy. Nowhere is that more apparent than in areas where increased amounts of energy are consumed—buildings, transportation, and industry itself.

"In buildings, which today account for 20% of the world's energy consumption, efforts to enhance energy efficiency are driving improvements in areas such as insulation and lighting. Coatings and innovative materials will play an increasingly important role in these efforts. For example, infrared (IR)-reflective technologies are being used in cool-roof coatings that can improve a building's cooling efficiency."

AkzoNobel are also prioritising energy reduction coatings. New colloidal silica self-cleaning paints are said to last up to 16 years, and other technologies in development include new binders for multi-substrate exterior coatings, deck and concrete restoration coatings, and



Left to right: Graffiti removal is estimated to be costing the UK over £1 billion a year; Anti-fly posting coatings are being tested; Rockpanel's Chameleon boards contain a crystal layer that allows them to dramatically change colour depending on the angle of view

liquid stain-repellent interior coatings. New binder technology will take VOC reduction a step further with the ability to remove VOCs and other pollutants from indoor air.

One signature project is a large new residential/commercial development in China using solar-reflecting paint. The Ju He Jia Yuan project in the eastern China province of Jiangsu includes 21 residential buildings of between 16 and 32 storeys and five commercial buildings with underground garages.

The buildings are being coated with Dulux Pro Ecosure Heatshield Flexi Exterior, a solar-reflecting paint that retains elasticity in both normal and low temperatures. It has been used to coat more than 260,000 square meters of exterior walls.

Ruud Joosten of AkzoNobel says: "China continues to be one of our most important growth markets and this particular project highlights the significant contribution our products can make to the process of urban transformation. It's also a great example of how the company's global Human Cities initiative is helping urban areas to cope with the challenges of the 21st century."

NO FLIES

At the other end of the spectrum, local authorities still have to deal with practical concerns.

Fly-posting is one problem that used to plague councils, at least in the UK, has improved over recent years. Anti-fly-posting coatings, which had become essential on street furniture, are now in much less demand. Part of the reason is Government-led pressure, backed by threats of prosecution on record companies. An unexpected factor, though, is reckoned to be a serendipitous by-product of the rise of social media. Facebook and Twitter have apparently absorbed much of the traffic which previously found its way onto street furniture and doorways.

TAGGED

Graffiti, however, is estimated to be costing the UK over £1 billion a year, with most councils absorbing the cost of removal for private property owners and small businesses. London Underground alone estimates an annual cost of £12.5 million, while scrubbing the walls of schools, hospitals and businesses costs London councils more than £7m.

Attempts to design out graffiti are being carried out in several areas of the city, including the use of protective coatings, anti-climb paint, anti-fly posting coatings, planting of natural screening such as thorn bushes or fast growing shrubs. A novel approach is being tested in Australia, where it \$34 million was spent last year to remove graffiti from Sydney's commuter trains. The Australian Department of Transport is deploying an electronic "nose", known as the mousetrap, that activates CCTV and alerts authorities in real-time when it detects paint marker and spray-can aerosols.

ANTI-GRAFFITI COATINGS

Anti-graffiti coatings, including polyurethanes, nano-particles, fluorinated hydrocarbons, and siloxanes, enable relatively easy removal of defacement.

Sacrificial coatings use inexpensive polymers such as acrylates, biopolymers, and waxes, which form weak bonds with the substrate to allow for easy removal. The coatings can be removed along with the graffiti by high-pressure washer, but then require re-coating.

Among the permanent coatings, polyurethanes have high chain stiffness and high crosslinking density which reduce the ability of the polymer to swell and absorb graffiti paint.

Fluorinated coatings make use of the fact that fluorine is the most electronegative element, showing very little affinity for the electrons of other elements. It decreases surface energy, minimizing contact with the graffiti paint in a similar way to a Teflon-coated pan.

The coatings are chemically inert and durable but expensive and difficult to apply.

Nanoparticle based coatings use hydrophobic and oleophobic molecules attached to silica nanoparticles. The effect is a coating that shows an equal dislike for both water-based and oil-based paints.

Siloxane coatings are hardwearing and easy to apply, with good anti-graffiti properties. PPG's PSX700 is used on many of London's highway structures and pedestrian subways as a clear topcoat for this purpose. Its inorganic chemical makeup protects substrate surfaces from being micro-pitted, preventing attachment of mildew and avoiding potential long-term corrosion problems, while its low surface energy limits the accumulation of stains, graffiti and dirt, and enhances self-cleaning. It also removes the need for a traditional mid-coat epoxy.

NEW FACADE

London infrastructure maintenance company Rhinoceros carry out regular work for Transport for London that generally includes use of siloxane anti-graffiti coatings. The company are also looking at new approaches, and have recently completed a trial installation using panelling alongside traditional coatings in one of London's many pedestrian subways.

Rockpanel cladding boards have been installed in one subway in North London where graffiti and surface deterioration have been long-standing problems. The installation is part of a trial being assessed by Transport for London. Rhinoceros say they needed to find a solution that would not be affected by water penetration through concrete retaining walls. Graffiti and damage resistance were also important factors. Tiles, which had been part of the original build, had been replaced in some areas, only to fail again due to water seepage. Normal coatings were used on some walls, but replacing tiles might have simply repeated the problems. The company is hopeful that cladding boards may be a practical alternative. The trial is one of several solutions being assessed, but has proved popular due to the striking appearance of the Chameleon finish.

ROCKPANEL

The Rockclad boards, by Dutch manufacturer Rockpanel, are made from rock fibre compressed with a



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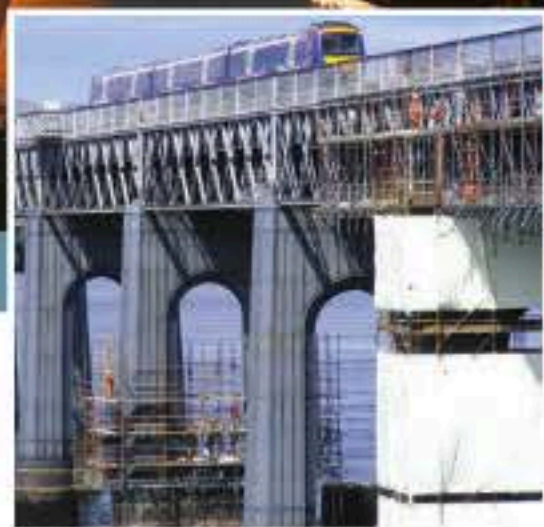
AT-M Manual



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small quantity of organic binding agent. This produces a lightweight panel which can be easily worked and handled, while still being fire-safe and environmentally friendly. The product is dimensionally stable and does not change with fluctuations in humidity or temperature. Besides RAL colours, the boards are available in special finishes such as 'Chameleon', which contains a crystal layer and dramatically changes colour depending on the angle of view. The board material itself is claimed to be as durable as stone and therefore resistant to the elements, while being as workable as wood: it can be cut to size on site and is installed with screws, nails and adhesive.

Rockpanel say the boards help designers and contractors achieve complex design and functional details of a project at low cost. The façades were recently used for a three-storey carving on the new 'Heart of the Campus' building at Sheffield Hallam University by Artist Christopher Tipping, designed to evoke the history of cutlery & silverware manufacture in the city.

PVDF FINISHES

Chippenham based supplier Newpaintco say they can match the complex finishes of many of the façade boards for on-site application, in the event of surface damage or to coat nearby walls. NewPaintCo's Ben Holt says that PVDF based coatings, using US manufacturer Arkema's Aquatec Kynar resin, provide an air drying water-based solution with VOC's of less than 5%. Holt says "Coatings based on PVDF have over forty years experience behind them and can now achieve a 25 year performance with excellent colour retention. We can create an in-the-can match even for iridescent finishes, which gives an extra alternative for areas where façade board installation is impractical".

Demand for PVDF coatings is underlined by PPG's announcement last year that they were reintroducing their DURANAR® ADS (Air-Dried System) fluoropolymer coatings, three years after the products were withdrawn from the market.

The next-generation formulation is based on a new fluorinated copolymer resin, and is designed to repair fluoropolymer coatings on architectural metals damaged during production or after field installation. The coatings can provide a wide range of colour options in solid, metallic, pearlescent and infrared-reflective (IR-reflective) pigment technologies.

Brian Knapp, PPG manager, coil and building products coatings, says the reformulated products will fill a specific demand that has been unmet since first-generation Duranar ADS coatings were discontinued. "Other than acrylic lacquers, which are not very durable, there has not been a user-friendly product available for touching up fluoropolymer coatings on products such as window frames, door frames, roofs and metal wall panels marred during fabrication or installation," he explains.

Because of its single-component formulation, Duranar ADS coating has the flexibility to be applied by fingernail brush for small touch-ups at the end of a production line, or to be spray-applied in the field to repair or refurbish weathered metal roofing or siding panels. ■

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