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For residential buildings, the most important requirements is to have a suitable waterproofing technology to make kitchens, bathrooms, roofs etc. completely waterproof with the latest nano-modified waterproofing compounds, says Dr AS Khanna, Chairman, SSPC India.



## All construction projects require a suitable corrosion protection strategy

**W**hat are the major factors involved in corrosion-related to construction projects? A construction project can be a residential complex, multiuse facility such as mall or multiplex, airport, railway station or a manufacturing establishment such as offshore structure, refineries, chemical or petrochemical plant or a power plant and wind mills and solar power plants. All of them require a suitable corrosion protection strategy. The aim of these construction sites is long durability, leak-proof buildings and distress-free structure. In order to achieve this, following strategy is adopted:

- Proper material selection with suitable corrosion protection technology based upon the category of the environment, C1, C2, C3, C4 or C5 as per ISO classification.
- Proper workmanship and paint application procedures so that the right material chosen do not fail due to bad application.
- Suitable strategy to monitor the deterioration of building structure with periodic repair and maintenance, as described in Corrosion Management and Structural Integrity Management procedures.

For residential buildings, the most important requirements are: leakages and fading of architectural paints, hence a suitable waterproofing technology to make kitchens, bathrooms, roofs etc. completely waterproof with latest nano-modified waterproofing compounds which assure more than a decade guaranty. Use

of energy saving coatings on roof, enhance roof life and reduce power used by air-conditioners.

Chemical and petrochemical industries require a better material selection which can withstand high temperatures and severe corrosive environments. Use of duplex stainless steels, corrosion-resistant super alloys with highly corrosion-resistant coatings which can withstand environment with pH 1 to 14, are required.

Open structures required for solar power plants require a first report of categorising the site as per C1 to C5 so that a proper coating thickness be recommended for steel tables holding the solar modules for 25 years.

For multiplexes, malls and public utility buildings such railway stations and airports, in addition to corrosion protection, there is another requirement of fire-protection for which a suitable intumescent coating requirement is a must.

**Which are the types of painting and coating solutions being used in corrosion protection?**

This is a big subject and cannot be answered in a few lines. But for simplicity I can describe the most recent classification of the various coating systems with their proper definition:

- Conventional coatings which are made by the addition of resin along with a suitable pigment and additives in a suitable solvent.

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Many of these coatings are formed on surface by solvent evaporation. The solvent in many cases is toxic which pollutes environment. Hence, these coatings are in the path of restriction and are being replaced by more eco-friendly, solvent-free or waterborne coatings. However, at present, more than 60 percent coatings available in the market are conventional solvent-based coatings.

- High-performance coatings: which in general perform very well in highly aggressive environments. These are mainly high build or solventless coatings with special addition of pigments which enhance durability, such as glassflakes, fibres, MIO etc. Such coatings are used in chemical petrochemical plants or at offshore structures to give life of more than 10-15 years.
- Smart coatings: The word smart has been introduced to those coatings which, in addition to protection, also do some action, such as water repellent – which results in self-cleaning coatings, self-healing which results in self-repair of broken or torn coatings, conductive coatings, or energy saving coatings. Many of these coatings use the latest principle of nanotechnology. Additional nano size materials (pigments or additives) enhance several properties of the coatings.
- Green or eco-friendly coatings: The coatings which do not use any toxic ingredients and are made using less energy are usually termed as Green Coatings. Many coatings made using water as solvent are categorised as Green Coatings.
- Fire-retardant or passive-fire coatings: For public structures and buildings, fire-proof, fire-retardant or passive fire coatings on steel structure is a must. Fire-retardant coating helps in reducing or spreading of fire. Passive fire coatings are also

called intumescent coatings whose main purpose is to delay the fire reaching a temperature of 500oC when the steel starts yielding.

**What is surface engineering and how it helps in solving engineering problems?**

Surface engineering has a very vast scope. It is involved in the manufacturing from a tiny syringe to a gigantic aeroplane construction to space vehicle. It has two important aspects:

- Creating smooth surfaces with large numbers of surface properties ranging from a smooth shining finish to highly corrosion protection surface or even a smart surface which can do some special function. There are large number of techniques used to achieve this job: from a simple hot dip method used to form galvanised zinc layer and the use of paint coating and brush to sophisticated engineering methods such as PVD/CVD, thermal spray and laser surface modifications. Also, it is possible to make smart surfaces, which are non-dust accumulators, water-repellent, conductive and anti-bacterial. The whole engineering industry takes advantage of these surface modifications.
- Surface engineering is also a solution provider to the mechanism of surface defects, surface degradation or surface improvement. Most of the sophisticated analytical techniques start from the surface;right from surface composition, surface morphology, to defects on surface – anything which improves or deteriorates the surface can be determined. Failure mechanism, whether it is due to friction, chemical attack, environmental factors, all can be known with the large number of surface analytical tools.

Paint coating is perhaps the trivial

method of surface protection but cannot be successful unless a suitable surface preparation and application procedure is followed with constant supervision and quality assurance. Very thin layers of coatings are applied by PVD and CVD methods required for sophisticated applications in aerospace and other allied industries. Thermal spray has changed the coating scenario as almost any metal or compound can be applied using this technique. Laser surface modifications can create a totally new surface alloy on an existing substrate.

**What kind of environment-friendly technologies are evolving currently?**

Environmentally friendly technologies are those which assure no additional pollution to existing environment, a technology which consumes low energy, no generation of toxic waste and, the most important, a technology which assures sustainability.

In paint coatings, there are three major points which need to be taken care: use of either solventless paint system, low VOC or waterborne coatings – all three are related to the solvent in the paint, most of which (benzene, toluene and xylene) are toxic to environment. That is several solventless systems such as solvent-free epoxies, polyesters, polyurea are in great demand today. Water is replacing toxic solvents. Sol-gel process is the latest waterborne technology to make highly protective chemical bonded, thin coatings.

Second is the use of carcinogenic materials, especially carcinogenic dyes and heavy metals such as lead, arsenic, mercury, cyanates and chromates (+6Cr). So, care is being taken to reduce lead level below 90 ppm, heavy metals in ppm or ppb levels. Leachable heavy metals are tested very carefully on all potable water applications. Use of Cr (6+) as primers are being replaced by Mo-based primers.

Care is also being taken to use sustainable materials as to conserve the natural resources. ■