International

A novel approach to combatting CUI

AkzoNobel Global Technical Support

Corrosion under insulation (CUI) costs industry millions of dollars annually. Moisture ingress into conventional insulation materials usually results in accelerated corrosion of the underlying steel surface, which can result in structural failure of the pipe, vessel or other insulated item. If left unchecked, CUI can result in leakage from pipes and vessels as a result of localised corrosion. If such equipment is operating under high pressure, this increases the potential for catastrophic failure.

CUI is generally a risk in the temperature range of -4°C to 175°C (25°F to 347°F) but the highest corrosion rates are normally experienced in operational conditions between 60°C to 120°C (140°F to 248°F). Under these conditions, corrosion rates of between 1.5 - 3.0mm per year have been reported, and the potential for corrosion doubles for every 15 - 20°C increase in temperature between 0 - 100°C (32 - 212°F).

The oil and gas market uses continuous high temperatures and has a wide variety of process conditions, which inevitably involve heat and cyclic conditions. Environmental conditions can be extremely harsh and thermal cyclic conditions impose a high degree of stress upon coatings which can result in a loss of physical properties. Steam-out cleaning and short but severe temperature spikes can also create cyclic conditions which accelerate corrosion.

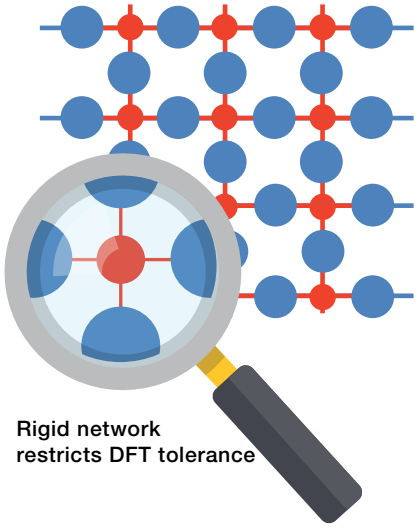
Traditionally, insulated pipework operating at elevated (or very low) temperatures has been coated using epoxy phenolic technology; this provides robust corrosion protection during downtime and excellent heat resistance in service. However, this traditional technology does come with some widely-recognised limitations from a quality assurance and productivity viewpoint at the point of application. Costs are driven higher by dry film thickness sensitivity and potential for in-service cracking, as well as slow drying/curing speeds, particularly at lower temperatures <10ºC (50ºF).

Interbond 2340UPC is a universal pipe coating based on a novel alkylated amine epoxy (AAE) technology which provides a versatile solution to the menace of CUI. Temperature resistant from -196°C (-321°F) to 230°C (446°F), a high cross link density coupled with a flexible chain modification grants AAE excellent resistance to CUI, alongside much greater tolerance to natural application variation. This reduces the need for remedial work, helping to keep the project schedule on time, whilst minimizing overall application costs. The high dry film thickness (DFT) tolerance greatly reduces the potential for cracking in service, helping to ensure excellent resistance to CUI and aggressive cyclic conditions in service. Figure 2 demonstrates AAE technology in a cyclic heating test after deliberate overapplication.

AAE technology has also been proven to surpass the traditional barriers of low temperature cure and long minimum overcoating intervals inherent of epoxy phenolic technology, forming a robust film that can cure rapidly down to -5°C (-23°F). A rapid, low temperature cure can allow applicators to double their productivity compared to traditional epoxy phenolic systems, as well as saving up to $1000 a day on heating costs in winter.

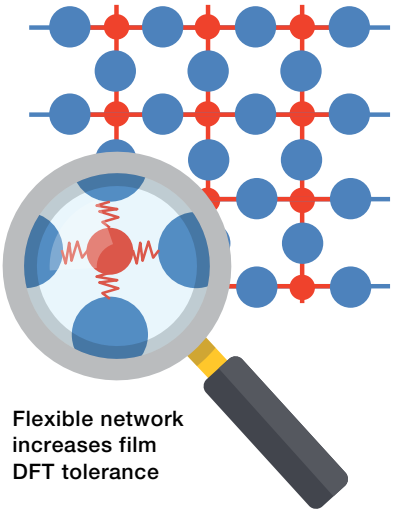
Fig 1 - Coating network analysis

Conventional Epoxy Phenolic



Rigid network restricts DFT tolerance

Alkylated Amine Epoxy



Flexible network increases film DFT tolerance

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Fig 2 - Cyclic heat testing. Test consists of heating to 200°C (392°F) for 8 hours and then leaving to cool to ambient for 16 hours. Test repeated 5 times.

AAE technology delivers the right balance of superior properties for both the applicator and the asset owner, increasing confidence that the performance expectations inherent within the contract chain are delivered and helping to greatly reduce the risk of CUI. Delivering superb ambient temperature ISO20340 resistance, Interbond 2340UPC is a truly 'universal' pipe coating, allowing simplicity of specification and application, resulting in increased confidence for asset protection and improved application flexibility vs traditional coating solutions.

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