INSTITUTE OF CORROSION

MARINE CORROSION FORUM

FOR ALL WET CORROSION ISSUES

Welcome to MCF – Marine Corrosion Forum / ICorr – Institute of Corrosion 2020 Autumn Webinars.

INSTITUTE OF CORROSION

MARINE CORROSION FORUM

FOR ALL WET CORROSION ISSUES

Institute of Corrosion partnering with

Graham Greenwood Sole, Corrocoat Ltd.

6th October 2020

INSTITUTE OF CORROSION

“A Review of Glass Flake Technologies and Shorter-Term Aerosol Solutions for Marine Corrosion Protection”

Graham Greenwood Sole

6th October 2020

About Me

- Graham Greenwood Sole
  - Graham graduated from Bradford University with a degree in Chemistry.
  - After 4 years at Allied Colloids in Bradford, Graham joined Corrocoat Ltd, a Leeds based leader in Glass Flake coatings and corrosion engineering in 1989.
  - Graham initially managed Corrocoat's laboratory and coating production departments, before moving into technical services in 1993.
  - He was promoted to the board in 2003 and is currently the Managing Director of Corrocoat's UK operations.
  - Graham is a member of the Oil and Colour Chemists Association, NACE, ICorr and a Chartered Chemist.

About US

- CORROCOAT Ltd
- Corrocoat has been providing cost effective anti-corrosion methods, materials and engineering rehabilitation expertise for over 30 years and enjoys a proven track record in solving corrosion-related problems throughout industry, operating across five continents from more than thirty locations worldwide. It's business is extremely diverse dealing heavily with the oil, power, mining, marine, petrochemical and many more industries that encounter corrosion issues. The presentation will outline the benefits and function of glass flake within high performance linings, options for the technology using differing resin systems, for the protection of equipment operating in harsh process environments. The presentation will discuss the advantages of this long-life technology and the critical importance of the right application techniques in pipework especially. Further, as the industry looks to shorter-term solutions to corrosion prevention, the use of surface tolerant epoxies (which has recently become more prevalent) and the development of single container two pack epoxy aerosol technology will be discussed, as this may well prove an ideal solution for holding back corrosion ahead of major intervention programmes by plant operators.

Q&A

Selection of Questions to Graham Greenwood Sole, Corrocoat Ltd

Post-Presentation 06/10/2020

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** For Internal Vessel Coating, earlier GF Systems typically had a life of 6 – 8 years before isolated failure, normally due to poor surface prep. What would be the life range now pls ?
- **A.** We have glassflake vinylester materials which have been in service in process vessels for over 20 years. The life and suitability with all coating systems will depend on the service conditions and temperature, but ensuring good surface preparation is critical in ensuring long term protection. Including not only the quality of blast, but also surface contaminants such as metallic salt.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What is the inspection interval of these glass flakes coating ?
- **A.** This is typically dictated by the client or their insurance requirements, inspection periods of 5,6,8 years etc. are not uncommon, some inspections may be shorter. Sometimes it is the inspections themselves which may cause the issues, with mechanical damage in the manway or during cleanouts, being the source of minor damage.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What are the factors which could affect the vulnerability of GFVE coatings applied to internal surfaces of pressure systems equipmen t? (what would make them prone to failure ?)

- **A.** The pressure itself is unlikely to be an issue. The highest pressure we have ever worked at in injection water being 6,800 PSI. You do however need to look at the whole environment and temperature etc., plus the likelihood of rapid depressurization. This is often referred to as explosive decompression. The quality of the application and the coating film will also affect performance. We have independently tested some of our materials for explosive decompression. This can be a complicated question.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What is the compatibility of GFVE with the biocide?
- **A.** For Vinylester glassflake linings generally very good. We would want to look at the composition including the type of solvents present, but its unlikely to be an issue.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** We are using polyester glass flake in our sea water cooing system piping and leakages observed due to failure in short time. It is very concerning for us ?
- **A.** Again this is a question which is difficult to answer without more information, such as the type of polyester, the service temperature, the quality of the work and how the coating is failing. Are the flange faces a problem for example, there are specific ways for protecting flange faces including rebating and fully coating, to prevent corrosion in these areas, but you would need more information, to start to answer this question in more detail.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Thanks for your presentation. You mentioned that it is better to select glass flake coatings on the basis of track record. With this in mind, do you have any track record on offshore wind farm foundations?
- **A.** Not as much as we would like, we have lots of structural steel references for seawater and offshore applications, we will be happy to discuss in more details.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Assume its micronized GF that's suitable for all geometries, is that the case ?
- **A.** Not really, micronized glassflake has very good edges retention properties, but milled and unmilled glassflake may be more appropriate for many service applications.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What are the limitations of the glass flakes in terms of erosional velocity?
- **A.** In the absence of any solids in the fluid, the highest flow velocity I normally recommend is 35m/s, add some sand and this will come down quite quickly.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** If we remove external insulation from an existing lined system is this likely to affect the lining (e.g. are cold wall effects an issue) ?
- **A.** This depends. If the coating is working towards the top end of its performance, and the insulation was required to help prevent osmotic blistering, yes this could cause an issue with the cold wall effect. If the temperature is modest and well within the coating's capability in that particular environment, it may have no effect on the lining.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Thank-you for the presentation. You mention the application of glassflake product with little or no preparation of the surface. What is the likelihood of the product maintaining its corrosion resistance property for the estimated 6 – 8 years of protection with or without surface preparation to prevent continuous attached?
- **A.** This depends on the system. Polyester and vinylester glassflake materials are typically full barrier materials and contain no corrosion inhibitors. They are almost always applied over an abrasive blasted surface. Some epoxy glassflake systems are surface tolerant and may be applied over mechanically prepared surfaces. The two-pack epoxy Aerosol product highlighted during the presentation, were originally designed to be applied over minimum surface preparation, as the original design brief was for short term protection e.g. 1 – 3 years. The idea being that the coating would hold corrosion in check, until a long-term solution could be employed. Increasingly people are using these Aerosols for coating small surface areas, where longer term protection is required. As such they are now using wire brushing, bristle blasting, abrasive blasting techniques, etc. In these cases, life expectancies of 7 years are possible and 10years plus may be expected in certain environments, if the surface is abrasive blasted. So, the life is dependents on many factors including: which product is used, how the surface is prepared, the quality of the application and what is the service duty.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What is the minimum pot life of your product for tropical region?
- **A.** An epoxy coating system cures by step reaction polymerisation and the pot life is largely dictated by the resin and hardener used. In hot conditions this can become a problem on some linings, as the reaction speed may become more difficult to control. Some people add solvent to control this, but this may affect performance, and in certain conditions plural spray application may be the best option. But it is generally not practical on most coatings, to adjust the product on site once it is made. Polyesters and vinylester cure by free radical polymerisation. Typical pot-lives of these materials for the spray applied products we manufacture, is about an hour at 20°C. We can however supply and use additional retarder with these materials, to help control pot-lives at high ambient temperatures. It is possible to continue to use conventional airless spray equipment at ambient temperatures in excess of 40°C. Such as within Middle East conditions. It is also possible to accelerate these materials during production, which allows them to continue to be effectively used down to minus 10°C.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Many thanks Graham. What is the reason for better resistance to cathodic dis-bondment?
- **A.** Cathodic disbondment is actually a really great measure of immersed adhesive strength. Within the products we make, we use specialist adhesion promotors to increase the adhesion of the materials to the substrate. If you test the adhesion on these materials using a tensometer, you will also always get a cohesive failure within the coating rather than an adhesion failure to the substrate. It is important to distinguish between immersed adhesion and dry adhesion, as is more often tested on coatings. Some products give great dry adhesion, but are still prone to delamination in service. A combination of great wet adhesion and excellent undercutting resistance are two factors which combine to give very high cathodic disbondment resistance.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** What is the maximum thickness of glass flake systems? and the options for the matrix is only vinyl ester or can use epoxy such as Novolac?
- **A.** The film thickness required is dictated by the service duty. A DFT of 1.00 – 1.50mm is fairly typical in many immersed service applications for Polyester and vinylester glassflake materials, less in some non-immersed application and for some epoxy products applications. In some applications were high erosion is expected, DFT'S may be higher. I have seen some specifications calling for 3mm due to sand erosion in bottom of process vessels, but DFT's in excess of this are rarely used or justified. In some cases where high erosion resistance is required modifying the product may be the most appropriate action.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Do you have any information on explosive decompression resistance for internal coatings in pressurised systems (say ~80bar)?
- **A.** Yes we have tested the two products we most widely used in process vessels at an independent test laboratory in Canada. The products were depressurized from 100 bar to atmospheric pressure in 15 minutes, at 100°C. I am happy to provide copies of the reports.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Is your product is available in Middle East region like UAE ?
- **A.** Yes, we have Corrocoat distributors in Abu Dhabi, Bahrain, Kuwait, Oman, Iraq, Qatar and Saudi Arabia.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- **Q.** Do you still provide supervising coating inspectors? there seems to be a lot of self-certification in the coatings industry?
- **A.** Corroserve can carry out work from start to finish. In an offshore application we have our own trained teams as was done last month on a project in the Southern North Sea. Often oil companies have their own fabric maintenance partners for vessel relining work etc., we are happy to provide Nace certified inspectors to work with them.

Questions and Answers – MCF / ICorr Joint Event Aberdeen – Oct.2020

- Note from Presenter;
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- I have answered these questions as succinctly as I can. Some of the questions are complicated and the answer really depends on a number of factors. The danger being that you end up with an essay rather than a short answer, which without all the facts may still not be fully comprehensive. I am happy to discuss specific points with the question providers and can be contact on +44 1132016243.
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- Regards
- Graham Greenwood-Sole
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THANK YOU FOR ATTENDING

This Webinar was brought to you by MCF working in partnership with ICorr and **Corrocoat Ltd**.