2021 Award Nomination

Title of Innovation:
Plasite XHT 400

Nominee(s)
Jeff Anderson, Carboline Company
John Kloepper, Carboline Company
Chad Remy, Carboline Company

Category:
Coatings and Linings

Dates of Innovation Development: ***(from month, year to month, year)***
March, 2016 to September 2020

Web site: Plasite XHT 400 Product Page

Summary Description: Plasite XHT 400 (Extreme High Temperature) is an outstanding heat resistant lining for long-term protection of fire tubes. Plasite XHT 400 utilizes a novel new resin system; Supoxy™ technology (patent pending), a highly cross-linked resin with extreme heat resistance and outstanding chemical resistance. Supoxy™ Extends heat and chemical resistance beyond current epoxy lining systems. This coating is ready for the rigorous tasks associated with corrosion on fire tubes associated with upstream oil and gas process vessels. The impermeable film, reinforced with proprietary ceramics, blocks aggressive vapors and solutions from film penetration and subsequent corrosion. This high cross-link density makes Plasite XHT 400 an exceptional choice for the daily stress associated with coating service for fire tubes.

Plasite XHT 400 provides superior protection with a single thin coat, without force cure, minimizing labor challenges and install costs. It uses low viscosity resins, allowing for a batch mix airless or pressure pot application, drastically improving the application characteristics for a coating in this market.

Full Description:

1. What is the innovation?

Plasite XHT 400 with Supoxy™ technology. A patent-pending, advanced epoxy with superior performance over existing bis-phenol A, bis-phenol F, and epoxy novolacs. This epoxy has a reasonably long potlife, batch mixable, thin film, and fast return to service with some unique performance properties. In most cases, there would be no need to heat cure the product, which aids in faster and lower-cost time to service. From an EH&S perspective, it is safe to handle for our plant employees and the end-user.

2. How does the innovation work?

On the surface, this seems like a standard 2 component batch mix epoxy; however, this innovation technology is an organic barrier resistant to a broad range of chemicals and tolerant of extreme heat. This provides asset protection beyond what many current technologies can provide.

3. Describe the corrosion problem or technological gap that sparked the development of the innovation. How does the innovation improve upon existing methods/technologies to address this corrosion problem or provide a new solution to bridge the technology gap?

This product improves the coating technology gap within the oil and gas industry by handling temperatures and pressures common linings cannot. Various coatings have been employed as linings to protect equipment for the containment, transportation, and use of corrosive or caustic chemicals. For example, baked phenolic linings often are employed for use as linings for sulfuric acid. However, the baking step required to cure phenolic coatings is difficult, costly, and is not feasible with certain tank configurations. Further, vinyl esters often are employed due to their resistance to oxidizing and acidic environments. However, vinyl esters may have limited high-temperature resistance and generally are required to be applied as thick films that may need to be reinforced. Moreover, in general, vinyl esters are difficult to apply and may expose workers to styrene during application. Additionally, epoxy novolac resins, in general, provide good chemical resistance. However, epoxy novolac resins have limited resistance to many acids, strong oxidizers, and are not resistant to extreme heat.

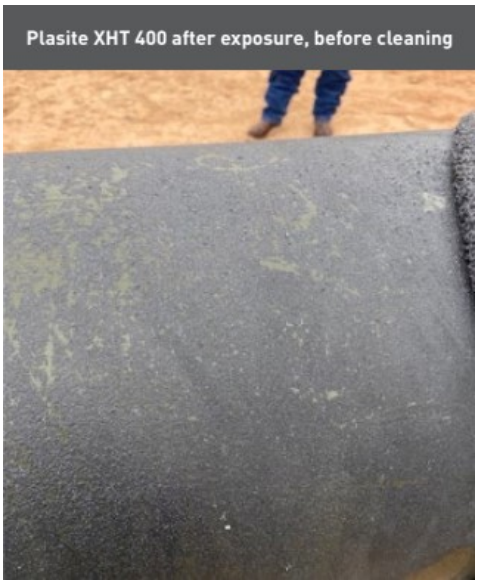
Therefore, we saw a market need for linings that can be easily applied, with a good stability to high temperatures and are resistant to aggressive chemicals that substantially degrade and destroy current technologies without the need for a force cure.

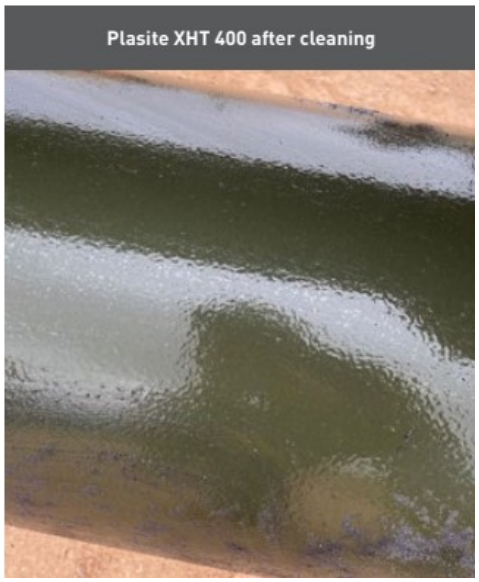
4. Has the innovation been tested in the laboratory or in the field? If so, please describe any tests or field demonstrations and the results that support the capability and feasibility of the innovation.

This innovation has been tested in both the lab and the field. Initially, this product was one of many prototypes being tested both by Carboline and third party laboratories using the Supoxy™ technology. Customers approached us with a need for an external fire-tube coating used in oil and gas separation equipment. Based on our work, we believed Plasite XHT 400 was suitable from a performance, cost, and application standpoint.

Laboratory testing consisted of such tests as standard immersion in various chemicals (coupons in jars), boiling water atlas cell, autoclave (high heat and pressure, multiphase immersion environment), weight gain/ loss studies, and glass transition work.

A field trial was conducted on a fire-tube positioned inside an oil/gas/water separator in West Texas. The fire-tube operated at 400°F. The coating was applied to the outside surface of the fire-tube and exposed to the internal fluids of the oil/gas/water separator. Liquid applied coatings were failing in less than 6 months in this service, but the Plasite XHT 400 looked pristine after 6 months (See inspection photo below showing the fire-tube before and after cleaning). It was placed back into service January 2020 and is still in service, showing no evidence of failure.





5. How can the innovation be incorporated into existing corrosion prevention and control activities and how does it benefit the industry/industries it serves (i.e., does it provide a cost and/or time savings; improve an inspection, testing, or data collection process; help to extend the service life of assets or corrosion-control systems, etc.)?

The benefit to Supoxy technology and Plasite XHT 400 is that it allows end-users to use coating as a corrosion control solution instead of deferring to expensive high nickel alloys. This reduces capital cost while providing a long-term performance solution.

PERFORMANCE FEATURE	ADVANTAGE	BENEFIT
Thin-film coating	Advanced protection with less material	Lower material costs
Ambient cure	Difficult force-cure procedures are avoided	Install cost savings/faster throughput
Single-coat	No primer required	Install cost savings/faster throughput
Ease of application	Plural component equipment is not required	Install cost savings
Quick return to service	Fast curing (24 hours)	Faster throughput/return to service

6. Is the innovation commercially available? If yes, how long has it been utilized? If not, what is the next step in making the innovation commercially available? What are the challenges, if any, that may affect further development or use of this innovation and how could they be overcome?

Plasite XHT 400 is currently commercially available for contractors to use and owners to specify. This product became available after its launch in September of 2020 after field testing and thorough examination of results from both field and lab tests. We are currently managing the overwhelming demand for more testing in various environments. Owners, contractors, and sales representatives in the field have seen the initial value in a product of this quality and want to test the boundaries of this innovative technology. Plasite XHT 400 continues to pass further and ongoing testing at an excellent clip, and we hope to rapidly react to the need for further testing requests to truly prove the durability and functionality of XHT 400 and the Supoxy technology.

7. Are there any patents related to this work? If yes, please provide the patent title, number, and inventor.

US patent pending, 63/047,325 filed 7-2-2020

Title – Epoxy Compositions

Inventors are Chad Remy, John Kloepper, & Tom Calzone