

Flue gas scrubber

BASF, Ludwigshafen

The largest of the three BASF power plants in Ludwigshafen and the power plant at Marl, both have to comply with environmental regulations and have accordingly been equipped with flue-gas desulfurisation plants. The plants don't work with limestone like most other power plants, but instead utilize an alternative method which enhances the opportunities for Atlac corrosion resistant resins.

WELLMAN-LORD

The difference is that at the BASF plant, the sulfur dioxide (SO₂) in the flue gas is not removed by converting limestone into gypsum during the scrubbing as in most other power plants, but is extracted with a solution of sodium sulfite (Na₂SO₃), recovered in the form of an enriched gas by heating the scrubbing solution, and exploited for chemical processing. This approach is known as the Wellman-Lord process. It not only recycles all the sulfur dioxide but also

eliminates the need to introduce and remove large amounts of solids. One difference between the gypsum process and the regenerative process is that the Wellman-Lord absorption fluid is, at pH1, considerably more corrosive than the limestone suspension (pH5). BASF therefore decided to manufacture the total 'cold end' (the section extending from where the flue gasses leave the heat exchanger to where they re-enter it) of the plants out of glassfiber reinforced vinyl ester resin.



SUMMARY

> 35m high gas scrubber self supporting

OPERATING CONDITIONS

> Sulphuric acid
Hydrochloric acid
Hydrogen Fluoride

ATLAC SOLUTION

> Atlac 430 bisphenol-A vinyl ester resin

IN SERVICE

> In service since 1988

BENEFITS

> low maintenance and long service life
easy repair
corrosion resistant

REMARKS

> No remarks

PROCESS CONDITIONS

The route traveled by the flue gas is divided into three sections. The contaminated gas enters the heat exchanger at 140°C and leaves it at 110°C; conditions that lead to the condensation of hydrogen chloride (HCl), hydrogen fluoride (HF) and sulfuric acid (H₂SO₄). Just before it enters the actual scrubbing tower the gas is quenched with water to 55° C. The quenching water is derived from the bottom of the scrubber, where the hydrogen chloride is absorbed, and contains 7% hydrogen chloride, 0.25% H₂SO₄ and 0.35% hydrogen fluoride.

THE ATLAC SOLUTION

The scrubbers are made out of glassfiber reinforced Atlac 430 bisphenol-A vinylester resin. At 9 m in diameter and 35 m high, they are the among the largest self-supporting FRP scrubbers in the world. The reinforcing ring distributed around the outside stabilizes the scrubbers against a vacuum of 1100 mmwc.

ECONOMICAL ADVANTAGES

BASF did not decide to use GRP simply because they were, at that time, one of the largest vinyl ester resin manufacturers, but because there are a number of sound economic justifications for

using vinyl ester:

- Composites have demonstrated long-term resistance with an expected operating life of 25 yrs, whereas rubber coatings have to be replaced at least every eight years which means the scrubber has to be down for three months.
 - Rubber must be applied to steel by hand in small sheets and vulcanized at room temperature and the seams between the sheets are especially weak. The vinylester structure, on the other hand, is an integrated structure that can be tested separately using cutouts from the maintenance and connection access holes.
 - When the rubber coating gets damaged, the plant must be shut down immediately for repairs. Damage to the vinyl ester structure can be temporarily repaired and the plant can continue to operate until its scheduled maintenance.
 - A vinyl ester structure can be repaired from the outside in just two days, whereas the rubber coating has to be repaired from the inside which entails removing and replacing the packing: an undertaking of around 14 days.
- All these factors show the economical advantages of a glassfiber reinforced structure in these type of applications.

About DSM

DSM Composite Resins is the largest producer of unsaturated polyester resins in Europe. With production facilities in many different European countries, DSM Composite Resins offers a wide range of resins, matching every conceivable processing and end-use requirement, in the most diverse applications. Local Sales offices and Technical Service laboratories enable close cooperation and partnerships between customers and DSM Composite Resins. Central Research & Development is fully equipped to develop and test new resins and to tune systems for optimal results in specific processing techniques. The development, service and manufacture of composite resins are certified according to ISO 9001.

About Atlac

For several decades Atlac resins have proven themselves highly suitable in applications where chemical and thermal resistance in combination with high mechanical properties are required. Atlac resins have outstanding corrosion resistance to a wide range of organic and inorganic acids, alkalines, solvents and bleaches. They are widely used for fibre-reinforced applications such as storage tanks, vessels, pipes and ducts. The Atlac resins can be processed by means of a wide range of fabrication techniques, including filament winding, hand layup, spray-up, and polymer concrete.

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Technical details

Application	Flue gas scrubber
Medium	flue gas containing Sulphuric-, Hydrochloric acid, Hydrogen fluoride etc
Conditions	pH 0-1 design temp 120°
Construction details	2.5 mm chemical resistant barrier layer based on Atlac 430
Resin	Atlac 430 bisphenol-A vinylester resin
Commissioning	Commissioned in 1988
Inspected	Inspected in 1999
Manufacturer	Plastilon - Finland
End user	BASF
Location	Ludwigshafen
Remarks	No remarks