GLOBAL SOLUTIONS

The Newsletter from DSM Composite Resins > October 2005 > No 7

TANKS, PIPES & RELINING

ATLAC resins
Old and new go hand-in-hand

The articles in this issue of Global Solutions show how long-established Atlac resins, with decades of proven performance (e.g. Atlac 382 and Atlac 430), can work alongside more recently developed products (e.g Atlac E-Nova FW 2045), to solve corrosion resistance challenges.

Resins from both groups are specified in well established applications like flue gas scrubbers of traditional power plants, as well as in relatively new end-markets like the geothermic industry.

Atlac contributes to a safer environment whether it is fossil fuel or alternative energy generation.

New developments, with thick laminates in Atlac E-Nova FW 2045 (see page 3), serve to illustrate how the best from the past can be combined with the latest technology. For example, the application below shows old and new Atlac grades being used together: quench (Atlac E-Nova FW 2045) and scrubber (Atlac 430).

IN THIS ISSUE

Atlac E-Nova FW 2045 and Atlac 430 used in a quench and scrubber

Atlac 430 in major flue gas desulphurisation project

Atlac 430, bisphenol A based vinyl ester resin – known for its high chemical resistance to both acids and alkalis - was selected for a challenging project for the new desulphurisation unit of the STEAG-RWE OHG power plant in Voerde (Germany).

This coal-fired power plant started up the new desulphurisation unit in September 2005. The unit is designed to lower the emissions and increase the efficiency of the Voerde plant .
The Belgian company ACS Plastiques Industriels, with a wealth of experience in many power plants in Europe, used Atlac 430 resin to filament wind the vast eight metre diameter, seven metre high shaft segments that were fitted together inside the existing concrete chimneys. More on page 2.

'Fantastic material sir!'

This is what I was told when visiting a large firewater pipeline project at the major DSM production site in Geleen (NL). Currently old steel pipes are being replaced by full GRP pipes based on Atlac E-Nova. Replacing traditional materials like steel with long lasting, light weight GRP is becoming an ever more accepted method in this industry.
In this issue you will find examples where GRP has proven its value over a long service life, but also new applications. Chemistry keeps on developing and new opportunities continually arise. Share with us your corrosion challenges and together we can provide optimal solutions that meet all the mechanical and chemical resistance requirements.

Jan Lodewijk Lindemulder
Business Manager Tanks Pipes & Relining

What is FGD - flue gas desulphurisation?

Flue gas desulphurisation is current state-of-the-art technology for major SO_2 emitters, like power plants.

The technology employs a sorbent to remove sulphur dioxide from the gases produced by burning fossil fuels. For economic reasons, systems that use a wet scrubber are the preferred choice for FGD coal fired power plants. After the majority of the fly ash has been removed from the flue gas, typically the gas will enter at 120 – 180°C. The gas is too hot for absorption, so it is necessary to first quench it with water to 50 – 60°C. The quenched gas is then passed in a counter current direction through an absorber where SO_2 is absorbed by sulphite, bicarbonate and carbonate alkali compounds dissolved in the recirculating scrubbing liquor. The amount of SO_2 absorbed depends on many factors, such as available alkalinity; the liquid/gas ratio used in the scrubber and mass transfer characteristics.

Gas leaving the absorber first passes through a mist eliminator to remove entrained water droplets, followed by a reheater section. There are several important reasons for reheating. Firstly, gas is saturated in water vapour and there is still enough SO_2 and SO_3 in the gas to present acid corrosion problems to downstream equipment (via condensation). Secondly, since the gas is cooled, there is not enough natural draft for the gas to exit the chimney without excessive pressure drop. For large units, an induced draft fan is required for draft control. The extent of reheating depends on energy and efficiency considerations, as well as concern about corrosion. Material will last longer when the flue gas is reheated. This is due to the high dew point of sulphuric acid.

In a natural oxidation wet FGD system, only the oxygen available in the flue gas is used. The by-product consists of mostly calcium sulphite. In a forced oxidation wet FGD system, blowers are used to supply additional air to the process. The final by-product is principally calcium sulphate dihydrate.

Eight meter diameter chimney sections being transported

Winding of extreme diameters

Diameters up to eight metres can now be produced thanks to the extended experience that ACS has with the resin, and the fact that Atlac 430 has been specially developed for the filament winding process.

LINING OF CHIMNEYS

The project included the lining of two chimneys: one 167 meters high, the other 178.5 meters high. Unfortunately the FRP lining sections are enclosed within the concrete chimney so they are not externally visible. Another part of the project involved the production of two insulated flue gas ducts with a length of 70.2 metres and 58.7 metres respectively. The technical specifications required a design temperature of 80°C, a design underpressure of 8mbar and a design overpressure of 20mbar. The medium composition is typical for desulphurised flue gas.

Installation on site

HIGH PERFORMING COMPOSITES

Based on its experience and expertise, ACS Plastiques Industriels selected ECR glassfibre to complement the high performance Atlac 430 vinyl ester resin, and created a composite with high mechanical strength and exceptional chemical resistance to acid vapours and their condensates.

TRANSPORT AND INSTALLATION

ACS built the pipes in its workshop in Seneffe (Belgium) and sent them by ship to the plant. This avoided the hazards and problems of on-site production or the transportation of such large constructions by road. Final assembly was made thanks to an ingenious lifting device installed at the top of the concrete chimney. During the project, the quality of the produced parts and connections were continuously checked by TÜV München. ACS completed the project within a timeframe of just 16 months.

Atlac E-Nova FW 2045 in thick laminates - Keep it cool!

The excellent chemical resistance performance of high temperature resistant VE-resins like Atlac 590 and Atlac E-Nova FW 2045 have often been highlighted. Good solvent resistance of these type of resins can be attributed to the much higher cross link density of the matrix compared with traditional Bisphenol A based vinyl esters.

However, it's because of this high cross-link density that these resins suffer from high reactivity shown in high exotherms, difficult to control shrinkage and risk for warpage when used to produce thick laminates (> 10 mm).
These problems are particularly noticeable when flanges have to be produced, which are an essential part of piping and tank systems.

But now the Expertise Centre is proud to present a unique curing system based on Atlac E-Nova FW 2045 and NOROX MCP (peroxide of Norac Andos AB), which is unaffected by these problems. It is the combination of these products that holds the secret, because other novolac vinyl esters (like Atlac 590) cannot manage this low peak temperature cure. It means that 30 mm thick (30% glass) laminates can be produced in one go without reaching exotherms higher than 50°C. Other curing systems and resins can easily generate twice this temperature. The result is reduced risk of uncontrolable shrinkage and reduced stresses in the final product.

THICK LAMINATES

Temperature development in CSM laminate (35% glass content).
Thickness = 30 mm. Produced in one go!
Gel time, 23°C: 25 – 40 minutes

ATLAC RESIN	TYPE	CURING SYSTEM	EXTRA ADDITION	EXOTHERM
590	Novolac	Cobalt/standard-MEKP		> 200°C
590	Novolac	Cobalt/standard-CuHP		> 200°C
E-Nova FW 2045	VEU	Cobalt/standard-MEKP		> 200°C
E-Nova FW 2045	VEU	Cobalt/NOROX MCP		100°C
E-Nova FW 2045	**VEU**	**Cobalt/NOROX MCP**	***5% α-methyl styrene***	**48°C**
590	Novolac	Cobalt/NOROX MCP	5% α-methyl styrene	106 °C

MEKP = methyl ethyl ketone peroxide; CuHP = cumene hydroperoxide; VEU = vinyl ester urethane

Temperature development in thick laminates

POSTCURE TO SECURE QUALITY

As well as the unique resin and peroxide combination, alpha methyl styrene is also added to make the system work. However this will not influence the final properties (chemical resistance) of the resin, as long as products are post cured (separately or in service). The first large scale trials with this newly developed curing recipe are running right now at customers and results will be reported as soon as possible.

FGD spray banks
An interesting application for Atlac

The scrubber where the SO_2 is removed from the gas passing through is an essential part of a Wet Flue Gas Desulphurisation unit. The absorption of SO_2 takes places during the reaction with sulphite, bicarbonate and carbonate alkali compounds, which are sprayed as a water slurry in a counter current direction of the gas stream. For this spraying process very complex shaped spray banks are constructed at different levels in the SO_2 scrubber.

One of the successful producers of FRP based FGD spray banks is Selip in Italy. Especially in China, but also in Europe and the USA, many new FGD projects, from 125 to 1200 MW plants, are being constructed using these products. Selip has built up extensive experience with these spray banks based on Atlac 580, vinyl ester urethane resin.
All products are produced by hand lay up, being the most suitable manufacturing production technique for such complex shapes. For a scrubber of 10 m diameter, a spray bank typically consists of 1 main pipe, 10 branch pipes and 95 spray nozzles, while for larger applications each level consist of 2 main pipes, 30 branches and up to 220 spray nozzles. Atlac 580 was selected for its easy processing properties such as fast impregnation and glass fibre wet out and good chemical resistance, especially against acid environments. This suitability of Atlac 580 was confirmed by passing tests for use in flue gas cleaning plants at TÜV

Selips spray bank

Case study

Geothermic Power Plant

A frequently asked question we are often confronted with is: 'Is postcure really necessary to obtain maximum (chemical) resistance properties?' We will address this question and say more about the 'hot topic' of postcuring in the next issue of Global Solutions which will be published at the beginning of 2006!

Atlac 382 popular in geothermal industry

The geothermal industry is interested in all areas throughout the world, wherever active and dormant volcanic centers are concentrated. A typical example of the growing popularity of this alternative energy source is the Philippines, where geothermal power plants extract energy from some of the country's 200 volcanoes.
Extracting the energy is a six stage process:

1. Bringing the geothermal fluids to the surface through production wells.
2. Separation of steam and geothermal brine in the satellite stations.
3. Cleaning of steam in the scrubbers before entering the turbines.
4. Re-injection of steam back to the earth.
5. Generation of electricity by using high velocity steam to turn the turbines of the power plant.
6. Converting electricity to usable forms (220 or 110 volts) and transmitting it to the consumer via power lines.

One of the leading suppliers of GRP products to the geothermal industry in the Philippines is Auric Industrial, a manufacturer of piping and ducting products, tanks, hoods covers, scrubbers, walkway systems and engineered custom made hand lay-up products. To withstand the highly corrosive, hydrogensulphide (H2S) laden, environment, Atlac 382 has been selected for geothermic plant components where temperature is not the limiting factor. These components consist of: the discharge pipeline from the turbine condenser to the cooling tower riser pipe, the steam ejector system and the cooling tower parts (riser pipe, control valves, fan cylinders, fan blades, end-wall casing and drift eliminators).

Its good mechanical properties, excellent corrosion resistance and the ability to customize GRP products are all factors that favour the selection of Atlac 382, propoxylated bisphenol A fumarate UP resin. DSM produces both Atlac 382 and Atlac 430 in Nanjing China for the Asian market.

EVENTS CALENDAR

FILAMENT WINDING 2005	12-14 October 2005, Brussels, Belgium	www.filamentwinding2005.com
REFINING & PETROCHEM. BUS. CONF.	20,21 October, 2005, London, United Kingdom	www.europetro.com
INT. EXH. FOR OIL, GAS AND PETROCHEM.	6-9 November, 2005: Dubai, UAE	www.ogsonline.com
KUNSTSTOFFROHRTAGE	14,15 November 2005, Würzburg, Germany	www.skz.de
INDIA COMPOSITES 2005	17-19 November 2005, Mumbai, India	www.airpma.org.
POLYM. FOR AUTOMOTIVE FUEL CONT.	6,7 December 2005, Hannover, Germany	www.polymerconferences.com

Headquarters

DSM Composite Resins
Stettemerstrasse 28
P.O. Box 1227
CH-8207 Schaffhausen

Switzerland

Phone +41 (0)52 644 12 12
Fax +41 (0)52 644 12 00

Customer Competence Center

DSM Composite Resins BV
Ceintuurbaan 5
P.O. Box 615
8000 AP Zwolle

The Netherlands

Phone +31 (0)38 456 94 76
Fax +31 (0)38 456 92 30

More Information

For more information, please look at our website:
www.dsmcompositeresins.com or
contact Kristel van Haaren
email: kristel.haaren-van@dsm.com