Corrosion protection for Flue Gas Desulphurisation Plants
As a result of increasing environmental protection regulations, Flue Gas Desulphurisation (FGD) Plants have been installed on many power plants worldwide since the early 1980’s. The predominant technology utilised is based on wet scrubbing which produces widely varying corrosive environments within the process equipment and flue gas ducting. Such an FGD Plant may require more than 4 different types of corrosion protection systems (see typical fields of application).

REMA TIP TOP today provides the most reliable and advanced corrosion protection systems for FGD Plants, combined with competent consultation services to owners, plant operators, engineers and application companies.

In order to provide the best corrosion protection available, our products have been developed based on extensive performance testing, and further by duplicating actual service conditions with a wide variety of chemicals under different temperature gradients.

Our detailed experience and knowledge of the systems characteristics and their response to the service conditions, form the basis for the most reliable and cost-effective solutions which can be found in this market. REMA TIP TOP offers state-of-the-art materials and services in accordance with DIN ISO 9001 to provide long term trouble free installations.

REMA TIP TOP linings provide excellent resistance against permeation, chemicals, abrasion and of course - corrosion.

Our quality programme, forms an integral part of our application process; in view of the critical nature of the lining work required in FGD installations. Working independently of our application teams, our quality control inspectors, strictly follow the QC parameters, parallel to the lining installation. Lining inspection may seem excessive and overbearing; but it is a vital necessity to achieve the best possible end product.
In FGD Plants, REMA TIP TOP rubber linings are installed, in areas where temperatures do not exceed 100°C. The combination of their excellent chemical resistance, together with equally good resistance against abrasion, allow them to be used for corrosion protection in absorbers, tanks, circulation and distribution pipes. In addition to chemical and mechanical resistance, the CHEMOLINE product range have very low permeation coefficient and water absorption values.

CHEMOLINE 4A, CHEMOLINE 4B and CHEMOLINE 4/CN, all based on Bromine Butyl Compounds, are the primary rubber products offered for lining in FGD Plants. CHEMOLINE 4B (Self Curing) and CHEMOLINE 4/CN (Pre-Cured) have been developed for the site application processes, whereas CHEMOLINE 4A is the product for conventional lining of vessels and pipes, where the vulcanisation process requires either hot air or steam under pressure.

The COROFLAKE range of lining and coating systems provide exceptional chemical resistance at a broader temperature range than rubbers and are typically used within FGD Plants for the lining of flue gas ducting, gas/gas re-heaters and tanks. The COROFLAKE lining range consists of, synthetic resin based products incorporating different types of fillers as reinforcements. Where vinyl ester resins are used, there is an increased thermal resistance which ranges between 180°C and for short periods, above 200°C (dry loads). By the addition of selected and graded fillers as reinforcements, the permeability of the COROFLAKE range is reduced to the lowest levels possible.

We don’t just stand by our products, we take responsibility for their performance. We are able to do so because of our years of experience in site management. Our technical service department is ready to train applicators personnel in the techniques of installation, safety requirements and quality control procedures associated with our lining systems.
FGD-Plant flow chart

Untreated gas approx. 125-160°C

Thickener

Sturry Processing Tanks

Absorber

approx. 80-110°C

Treated gas approx. 45-65°C

Stack

Untreated gas approx. 125-160°C

Thickener

GTH

approx. 80-110°C

REMA TIP TOP – Rubber linings

REMA TIP TOP – COROFLAKE systems
### Fields of application in FGD Plants applicable to the Limestone Gypsum Process

<table>
<thead>
<tr>
<th>Component</th>
<th>COROFLAKE 18</th>
<th>COROFLAKE 23</th>
<th>COROFLAKE 24</th>
<th>COROFLAKE 28</th>
<th>COROFLAKE 48</th>
<th>COROFLAKE 60</th>
<th>TOPLINE 68</th>
<th>TOPLINE W</th>
<th>CHEMOLINE 4A</th>
<th>CHEMOLINE 4B</th>
<th>CHEMOLINE 4/CN</th>
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<tbody>
<tr>
<td><strong>1. Ducts, GGH and Stack</strong></td>
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<td><strong>4. Pits/Channels</strong></td>
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</table>

**Recommendation**

**Alternative**
# Linings and coatings

## Resin-based linings and coatings for FGD Plants

<table>
<thead>
<tr>
<th>Component</th>
<th>COROFLAKE 18</th>
<th>COROFLAKE 23</th>
<th>COROFLAKE 24</th>
<th>COROFLAKE 28</th>
<th>COROFLAKE 48</th>
<th>COROFLAKE 60</th>
<th>TOPLINE 68</th>
<th>TOPLINE W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fillers</td>
<td>S = Silica, A = Aluminium oxide, C = C Glass, M = Mica</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>S</td>
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<tr>
<td>Reinforcements</td>
<td>GM = Glass Mats, IF = Inertflakes, GF = Glass Flakes</td>
<td>GF</td>
<td>IF</td>
<td>IF</td>
<td>GF</td>
<td>GF</td>
<td>IF</td>
<td>GM</td>
</tr>
</tbody>
</table>

### Build up
- Primer coat
  - 1
- Body coat - No.
  - 1/2
  - 1/2
  - 2
  - 2
  - 1
  - 1
- Glass reinforcements
  - -
  - -
  - -
  - -
  - -
  - 1
  - 1
- Top coats - No.
  - 1
  - 1
  - 1
  - 1
  - 1
  - 1
- Dry film thickness mm
  - 2.0
  - 1 / 1.5
  - 1 / 1.5
  - 1.2
  - 0.9
  - 0.4
  - 2.5
  - 3.2
- Substrate
  - C = Concrete, S = Steel
  - S
  - C, S
  - C, S
  - S
  - C, S
  - C, S

### Performance data - Mechanical properties

<table>
<thead>
<tr>
<th>Adhesion - to steel (DIN ISO 24624) MPa</th>
<th>&gt; 4</th>
<th>&gt; 7</th>
<th>&gt; 7</th>
<th>&gt; 7</th>
<th>&gt; 7</th>
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<tbody>
<tr>
<td>- to concrete Mpa **</td>
<td>&gt; 1.5</td>
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<tr>
<td>Abrasion resistance (ASTM - D 4060) mg</td>
<td>68</td>
<td>90</td>
<td>92</td>
<td>55</td>
<td>55</td>
<td>100</td>
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<td>Barcol hardness (DIN EN 59)</td>
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<td>30</td>
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<td>Compressive strength (DIN EN ISO 604) MPa</td>
<td>42</td>
<td>40</td>
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<td>42</td>
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<td>35</td>
<td>50</td>
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<td>Tensile strength (DIN EN ISO 527) MPa</td>
<td>27</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>25</td>
<td>18</td>
<td>65</td>
<td>35</td>
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</tbody>
</table>

### Physical properties
- Max. service temperature dry (°C)
  - 160
  - 220
  - 120
  - 180
  - 240
  - 110
  - 150
  - -
- Service temperature immersion (°C)
  - 90
  - 70
  - 70
  - 70
  - 90
  - 60
  - 80
  - 75
- Permeation resistance (ASTM - E 96) perm-inch
  - 0.001
  - 0.0016
  - 0.0014
  - 0.001
  - 0.0008
  - 0.07
  - 0.005
  - 0.0031
- Crack bridging capabilities (DfBT) mm
  - -
  - -
  - -
  - -
  - -
  - -
  - 0.3
  - -

### Application method
- H = Hand applied, T = Trowel, S = Spray, B = Brush or Roller
- T
  - S/B
  - S/B
  - S
  - S/B
  - S/B
  - T, H, S
  - T, H
Rubber linings for FGD Plants

<table>
<thead>
<tr>
<th>Rubber type</th>
<th>DIN-Norm</th>
<th>CHEMOLINE 4 A</th>
<th>CHEMOLINE 4 B</th>
<th>CHEMOLINE 4/CN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>soft rubber</td>
<td>soft rubber</td>
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<tr>
<td>Polymer</td>
<td>DIN ISO 1629</td>
<td>BIIR</td>
<td>BIIR</td>
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<tr>
<td>Vulcanisation</td>
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<td>autoclave</td>
<td>self vulcanising</td>
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<td>Thickness mm</td>
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<td>4 5 6</td>
<td>4 5 6</td>
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<tr>
<td>Density g/cm³</td>
<td>DIN 53 479</td>
<td>1.27 ± 0.02</td>
<td>1.27 ± 0.02</td>
<td>1.30 ± 0.02</td>
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<td>Hardness Shore A</td>
<td>DIN 53 505</td>
<td>55 ± 5</td>
<td>50 ± 5</td>
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<td>Tensile strength N/mm²</td>
<td>DIN 53 504</td>
<td>≥ 5</td>
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<tr>
<td>Elongation at break</td>
<td>DIN 53 504</td>
<td>≥ 370%</td>
<td>≥ 370%</td>
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<tr>
<td>Adhesion to steel N/mm²</td>
<td>DIN 53 531</td>
<td>≥ 4</td>
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