

CARBOGUARD® carbon fiber-reinforced process equipment

SGL Carbon developed carbon fiber-reinforced graphite and silicon carbide (SiC) parts to ensure the operational reliability and the safety of its equipment. This technology is named CARBOGUARD. For more than 30 years, hundreds of customers around the world have benefited from the unmatched reliability and performance of the CARBOGUARD equipment in the toughest process conditions.

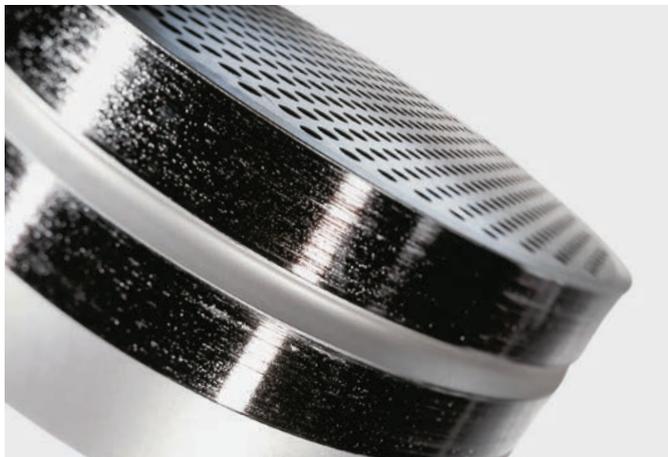
Application

CARBOGUARD increases the operational reliability of DIABON® graphite and other materials (e.g. SiC tubes) enabling higher efficiency and throughput. It extends the range of application under high-stress conditions like temperature or pressure shocks. CARBOGUARD is mainly used for tube sheets, headers, column sections and especially for tubes.

Technological benefits

CARBOGUARD shows the following key features:

- Enhanced mechanical strength
- 30 to 40 % higher bursting pressures
- Leakage protection up to 3 – 5 bar differential pressure
- Shatter guard
- Higher efficiency



↑ DIABON graphite tubesheet with CARBOGUARD



↑ DIABON graphite tubes equipped with CARBOGUARD

Customer benefits

CARBOGUARD improves the mechanical properties of graphite and SiC components. This will allow our customers to operate their equipment with:

- **Highest possible safety**
- **Longer life time**
- **Significantly reduced shut downs for maintenance**
- **Lower total cost of ownership**

Unmatched technological leadership

SGL Carbon optimized this technology continuously in the last decades, resulting in an unmatched quality of its carbon fiber-reinforced components:

- Highly pretensioned carbon fibers are wrapped around DIABON graphite or SiC components
- Fully automated wrapping technology ensures maximum thermal conductivity of tubes and reproducible high quality

Details of technological benefits

Increased bursting pressure by 30 – 40 %

Components with CARBOGUARD are more resistant to steam hammers and high operating pressures. For example, the bursting pressure at room temperature of CARBOGUARD graphite tubes is 30 to 40 % higher than the one of non-reinforced DIABON tubes. This allows a substantial reduction in the number of broken tubes in the most demanding applications such as the concentration of industrial phosphoric acid.

Leakage protection up to 2 – 5 bar of differential pressure

Should a longitudinal crack occur as a result of overstressing, the reinforced tube will not allow any major leakage up to a differential pressure of some 2 to 5 bar. Only a hairline crack will usually occur and is held tightly closed by the pretensioned fibers. Hence, the reinforcement prevents spilling out of process media from the crack and uncontrolled release of

product in large quantities. Usually the piece of equipment can continue to be operated without interruption until the next planned shutdown resulting in less downtimes.

Shatter guard

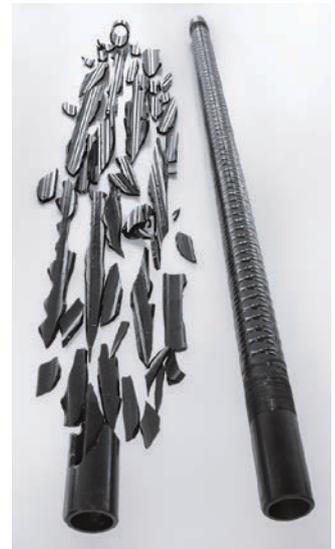
Should a CARBOGUARD component like a tube or a column segment crack as a result of overstressing by a e. g. pressure surge, CARBOGUARD will prevent the uncontrolled release of debris and hence lower the risk of damages to surrounding parts.

Improved mechanical stability for large components

Large graphite components such as column sections or tube sheets of heat exchanger can also be equipped with CARBOGUARD. Damages by overstressing can be reduced significantly especially in the toughest process conditions where risk of temperature or pressure shocks exist.



↑ Large DIABON graphite column with CARBOGUARD



↑ Breaking behaviour of a silicon carbide tube without (left) and with CARBOGUARD (right)



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TIS CAG.00

05 2018/0.25 E Printed in Germany

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