

DIABON® cementing technology

SGL Carbon's DIABON graphite equipment portfolio comprises of heat exchangers (plate, block, tube, and groove), as well as columns, vessels, quenchers, synthesis units and reactors, and pumps.

Our typical material grades like DIABON NS1, NS2, and CT are based on solid fine grain graphite cylinders and blocks or tubes with a phenolic resin and/or fluoropolymer impregnation. Graphite provides excellent corrosion resistance as well as an outstanding thermal conductivity, better than many metals. The impregnation prevents leakage by the porous graphite and can improve mechanical strength up to a factor of 3.

Unlike metals and certain plastics, graphite materials cannot be welded, sintered or otherwise joined by applying high temperatures or mechanical forces. In order to obtain mechanical bonding between graphite parts and, in addition, separation of the media, a permanent gluing technology has been developed, termed cementing.

The cementing process is monitored thoroughly with the consequence that the cementing factors obtained are equivalent to the usual welding factors of other materials.

Basic rules of cementing

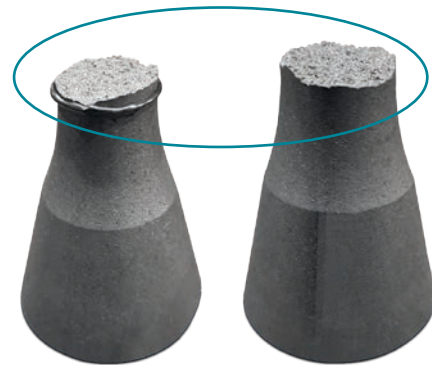
The cement for DIABON graphite equipment consists of a corrosion-resistant synthetic-resin binder and graphite powder plus a catalyst.

With more than 60 years of experience and several ten thousand graphite equipment units on the market we have successfully developed some basic cementing rules:

- We avoid the excessive use of cement. Surplus/excess cement has negative effects on thermal performance and can cause drainage problems, endangering maintenance staff and the equipment at the same time.
- We avoid blunt cementing. The joint is designed to respect mechanical load conditions.
- We take thermal conditions into consideration. The joint must not act as a heat barrier.

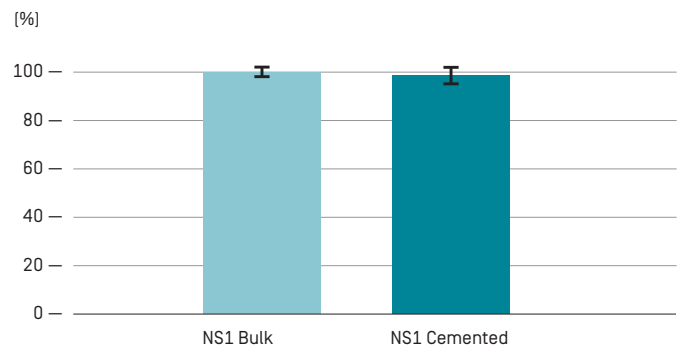
Mechanical performance of SGL Carbon's cementing technology

The mechanical properties of our cementing technology is continuously monitored. Testing is done acc. DIN 51914. One may be surprised to learn that typically the parts do not fail at the cement joint but rather in the bulk.



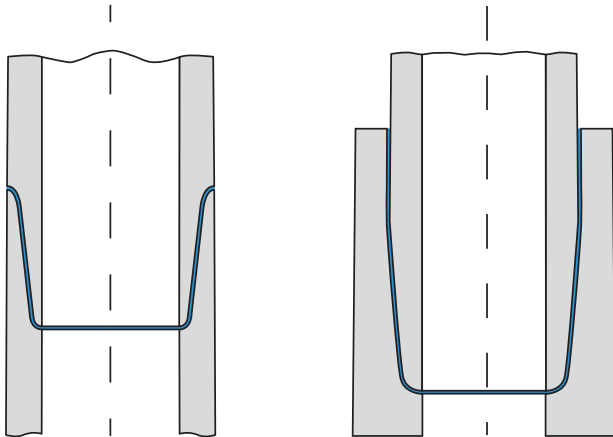
The following graph underlines this phenomenon: SGL Carbon's DIABON cementing technology provides material connections with mechanical performance at par of the DIABON bulk (jointing factor $\cong 1$)

Mean tensile strength is scaled to 100 % [95% confidence interval, min. 25 samples]



Tube/tube and tube/tubesheet connection

Stress peaks at the joint position are minimized by using the appropriate joint design. This means for example, that SGL Carbon avoids blunt cementing. We also adapt tube joint design depending on whether the tube is cemented into the tube sheet or connected to another tube.



↑ tube/tube connection

↑ tube/tubesheet connection

Did you know...

Our DIABON tubes have to pass three core quality tests before they leave our workshops. A stringent and consequent quality monitoring is applied acc. ISO 9001:

1. Pressure test at > 20 bar air.
2. Leakage-test after any special machining or cementing procedures, if applicable.
3. Final acceptance test after equipment assembly prior to shipment.

Segmentation technology for high diameter graphite equipment

Although our cementing technology provides the needed mechanical strength, it may have a detrimental effect on the thermal properties like overall heat transfer rate. It is sometimes observed with tube sheet segmentation perpendicular to the heat exchanger axis that it acts as heat barrier and results in thermal stresses and tube sheet failure. SGL Carbon therefore avoids cementing when possible.



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Did you know...

SGL Carbon is the only producer of high quality monolithic graphite equipment up to 1650 mm diameter.

For diameters above 1650 mm an optimized segmentation technology is used to avoid thermal stresses. When we design tubesheets this results in:

- max. 3 segments,
- nearly no horizontal cementing barriers.

This avoids thermal barriers and ensures longest lifespan. Other typical applications benefiting from our advanced segmentation technology are high capacity DIABON columns and quenchers.



↑ SGL Carbon's advanced segmentation technology put to use in a quencher with 2950 mm diameter

TCS DIABON Cementing.00

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