

Improved solutions for corrosive processes with Graphite Technologies

Equipments:

GT_BLOC
GT_TUBE
GT_CUBIC
GT_DISC
GT_PLATE
GT_TOWER
GT_BATH
GT_FIN
GT_JET
GT_CP
GT_PF

Materials:

GT_KELITE
GT_KELITE+
GT_FLON
GT_FLON_VC
GT_OXY_FLON
GT_CARB
GT_CARB+

Systems:

Absorption
Dilution
Concentration
Reaction
Mixing



www.graphite-technology.com

THE CARBON EXPERT COMPANY



Our Mission

Allow customers to confidently and smoothly operate media in harshest conditions of corrosion, fouling, temperature and pressure.

Allow customers to push forward the efficiency and cost effectiveness of their chemical processes.

Offer and supply process systems, equipment and components made of carbon-based materials.

Our Company

Graphite Technology, a synonym for outstanding solutions using graphite components for the chemical processes industries. You can rely on our graphite and the specialists of Graphite Technology – The Carbon Experts Company.

Since years specialists at Graphite Technology have developed and constructed graphite components with the highest resistance to corrosion. Our engineering team performs not only process design for heat exchangers, but also stress and mechanical calculations for the equipment which complies to worldwide standards.





Our Advantages

Our projects include design and efficiency improvement, revamping and debottlenecking of existing exchangers.

We supply the widest portfolio of solutions for chemical processes industries. We manufacture the most reliable equipment on the market with user friendly features.

Our equipments are designed to be used in the harshest conditions with unique features improving reliability, extending lifetime, reducing maintenance costs. Unique and patented technologies to protect against erosion, water and steam hammering, vibrations, mechanical and thermal shocks.





The complement and alternative to high nickel alloys, Tantalum, Titanium for corrosive applications.

Main Markets

- Pharmaceutical
- Fine chemical
- Agro chemical (pesticide, herbicide, fertilizer)
- Steel industries (pickling and acid regeneration plant)
- Hydrometallurgy
- Petro chemical (plastics)



HCl pickling liquor heater



Chlorine incinerator scrubber unit, weak acid cooler

Main Applications

- Heating, cooling, evaporation, and condensation of corrosive medium.
- Waste acid, waste water and gas treatment (scrubber, falling film absorber, boiler).
- Concentration, crystallization by evaporation with hydrochloric acid, sulfuric acid or phosphoric acid.
- Separation and purification of corrosive chemical products.
- Acid dilution units.
- Vacuum steam jet technology.
- Chemical reactions.

GT, synonym for graphite heat exchangers and equipment with improved design.



Reactor condenser for xylene / thionylchloride, pharmaceutical

Our unique equipment design is "user friendly" and allow harshest operating conditions.

- SHOCK PROTECT® and HAMMER PROOF® against water/steam hammering stress.
- STABLE LOAD® against thermal stress fatigue.
- STRESS FREE® again piping stress
- High thermal shock resistance.

TOYO TANSO manufactures the world highest quality graphite in Japan.

TOYO grade selected by GT for heat exchanger, shows the highest mechanical strength and fatigue resistance on the market.

GT_TOYO grades are characterized by:

- The highest level of corrosion resistance among graphite materials.
- The highest mechanical performances on the market.
- The highest thermal transfer efficiency on the market.



Sulfuric acid 85 % -160 °C cooler

TOYO TANSO
Inspiration for Innovation.

GT. synonym for exceptional graphite grade for extended lifetime.

Each producer of graphite has its own specifications and formulations which are tailored for final application.

GRAPHITE TECHNOLOGY selects and tests the graphite into its pilot equipment which will give the best resistance to corrosion, to thermal and mechanical shocks, at the best price.

A strict qualification process is applied to all graphite grades prior their use in production.

Our grade GT_KELITE+ TOYO is the world highest quality of graphite for chemical equipment thanks to our close collaboration with TOYO TANSO (Japan).

Our unique TOYO's "ultrafine grain" (down to 8µm) with very high mechanical and thermal strength, high thermal conductivity withstand the harshest operating conditions.



Impregnated Graphite

Impregnation of graphite will give imperviousness property to graphite. We use proprietary resin and latest technology which shorten production lead time. Five grades of impregnated graphite, using three different resin types are available to cover most applications.

We are the only company in the world that produces process equipment using nuclear grade isostatic pressed graphite impregnated with pure PTFE.

Our GT_FLON is suitable for the highest corrosive media (stainless steel pickling) or a variety of combined applications, far superior to traditional phenolic resin grade impregnated graphite.

Our new GT_VCARB is suitable for strong oxidizing media at higher concentrations and temperatures. GT's current material range covers almost all corrosive chemicals and high temperature applications.

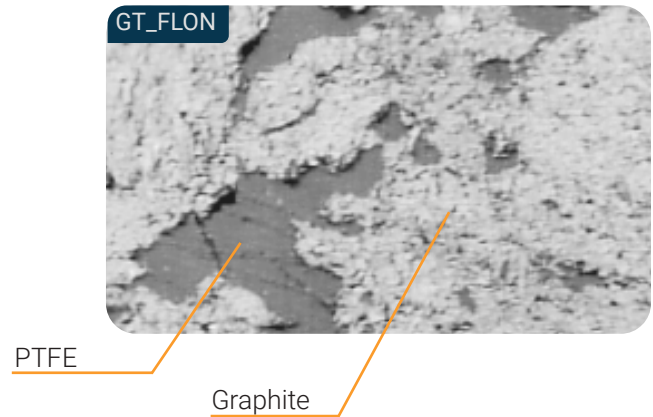
Typical values	GT_KELITE	GT_KELITE+	GT_FLON	GT_CARB	GT_FLON VC
Graphite grain size (mm)	0.8 - 0.5	0.043 - 0.008	0.043 - 0.008	0.8-0.008	0.008
Impregnant type	Phenolic	Phenolic	Pure PTFE	Carbon	Pure PTFE
Density	1.82	1.89	1.87	1.89	2.1
Flexural strength (MPa – ASTM C651)	27	43.0 – 50.0	32.0 – 42.0	32.0 – 42.0	>42.0
Compression strength (MPa – ASTM C695)	65	118.0 – 159.0	91.0 – 130.0	80.0 – 130.0	>130.0
Young modulus (GPa – ASTM C559)	7.0-9.0	11.0	7.0-11.0	9.0-11.0	>11.0
Max permissible material temperature (°C)	200	250	250	430	600
Recommended for	Moderate pressure/temperature/corrosion.	Higher pressure / temperature. Frequent thermal cycling. Higher corrosion resistance.	Highest corrosion resistance even in oxydative and strong base media. Frequent thermal cycling.	Highest temperature in non oxydative media.	Highest temperature in highest oxydative media.

Antioxidant Graphite Technology

GT_FLON is especially suitable for strong solvents and organic chemicals. Compared with traditional phenolic/furan impregnated resin, it has excellent corrosion resistance, dissolution resistance and swelling resistance. It is specially developed for steel pickling and agrochemical. This material can replace many special metal heat exchangers, such as titanium, tantalum, Hastelloy.

Combined with GT's unique OXY and VCARB processing technology, it can protect the graphite itself and play the best role of oxidation resistance.

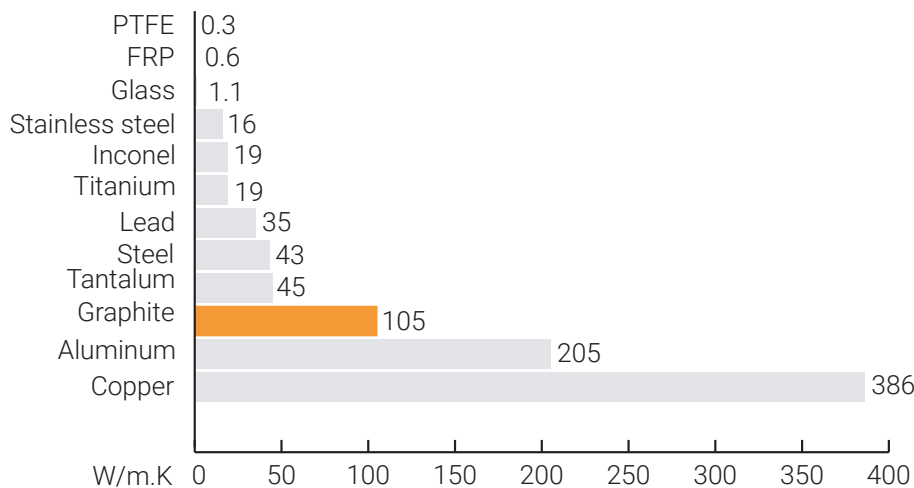
Micrography of impregnated graphite structure (x1000)



Graphite Material

The word graphite originated from Ancient Greek “graphein”, means “write”.

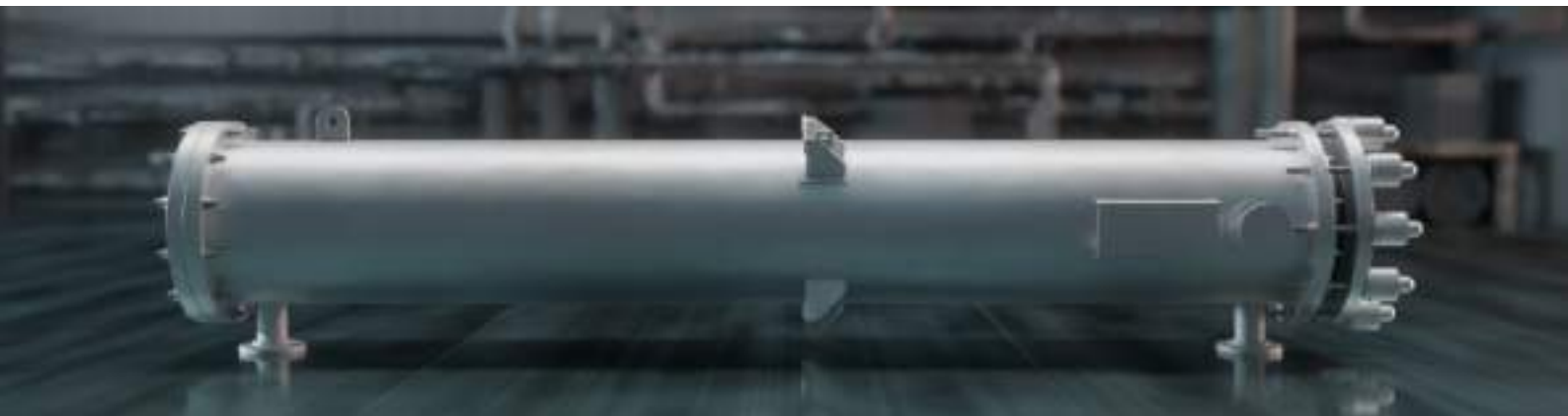
Graphite, a synthetic or a natural form of carbon, is usually produced at temperatures above 3000°C. Graphite has a high temperature of 3500°C and is an excellent conductor of heat and electricity. Graphite is usually in the form of a black soft solid bonded in layers.



Graphite is characterized by its high level of corrosion resistance and its thermal conductivity is much greater than most comparable corrosion resistant materials.

Manufacturing process of graphite raw material, requires a lot of energy during compression, baking and graphitization. A very long process which can take several months.

Graphite heat exchangers



GT_BLOC

Round modular blocks heat exchangers

- Compactness.
- Modular construction.
- Fast assembly / disassembly.
- Standardized spare parts
- Possibility to use corrosive media on both side with a protective coating / lining on shell side.
- Available in GT_KELITE(+) / GT_CARB+ / GT_FLON
- From 0.3 m² to 800 m².
- Up to 500 °C, 20 barg.
- Monoblock or multiblocks configurations.

In standard

- SHOCK PROTECT®
- STABLE LOAD®
- STRESS FREE®
- FILT-IN®
- HAMMER PROOF®

Optional

- C-HARD® erosion reinforcement



GT_DISC

Discs and frame heat exchangers with slot or annular groove design

- Excellent heat transfer adapted to reactor condenser and subcooler.
- Compactness.
- Modular design with ability to reduce or extend capacity or footprint.
- Fully dismantle without heavy components, easy cleaning.
- Possibility to use corrosive media on both sides (economizer).
- Low pressure drop, free-flow.
- Auto dry surface.
- Available in GT_KELITE+ / GT_CARB+ / GT_FLON
- HTA from 0.5 m² to 80 m².
- Up to 250 °C, 6 barg.
- High performance with viscous media.

In standard

- STRESS FREE®

Optional

- HAMMER PROOF®



GT_TUBE

Shell and graphite tubes heat exchangers

In standard

- SHOCK PROTECT®
- STABLE LOAD®
- STRESS FREE®
- FILT-IN®
- HAMMER PROOF®

Optional

- C-HARD® erosion reinforcement
- Falling film design
- Carbon fiber reinforcement for high vibrations and stress resistance

- High heat transfer area, heavy duty up to 1000m²
- High process / service section for big flow (15,000 m³ liq./h).
- Gaskets only at tubesheet and header location.
- Available in GT_KELITE (+).
- Gasketed baffle on service side for cooler.
- Up to 180 °C, 6 barg.
- Monolithic tube sheet up to 1,8 meter dia.
- Jointless tube length up to 10 meters.

GT_PLATE

Plates and frame heat exchangers

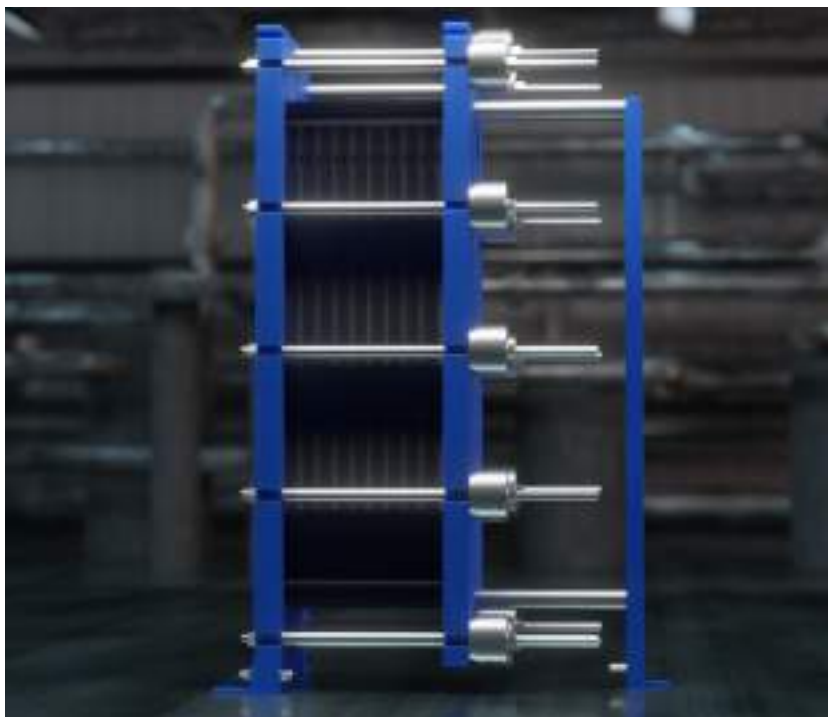
- High performances.
- Compactness.
- Modular design with ability to reduce or extend capacity or footprint.
- Possibility to use corrosive media on both sides (economizer).
- Availazble in GT_KELITE+/ GT_CARB+ / GT_FLON.
- From 0.3 m² to 40 m².
- Up to 200 °C, 6 barg.

In standard

- STRESS FREE®

Optional

- HAMMER PROOF®
- FREE FLOW for dirty media®



Graphite equipment

GT_CUBIC

Cubical block heat exchangers

- Possibility to use corrosive media on both sides (economizer).
- No gasket between 2 sides media (no contamination with gasket failure).
- Outstanding corrosion resistance (GT_KELITE(+)) / GT_CARB+ / GT_FLON).
- Monoblock or multiblocks configurations up to 250 °C, 10 barg.



GT_JET

Ejector mixers and jet vacuum technologies

- Jet vacuum systems.
- Ejector mixer for chemical reactions (gas/liquid, liquid/liquid).
- Outstanding corrosion resistance (GT_KELITE(+)) / GT_CARB+ / GT_FLON).
- Custom design.

GT_BOILER

Block horizontal balanced boiler

- Custom design
- Outstanding corrosion resistance (GT_KELITE(+)) / GT_CARB+ / GT_FLON / GT_OXY_FLON).
- No pumps and circulation lines are required
- Up to 250 °C, 20 barg
- The heat medium of evaporation can be steam or thermal oil



GT_TOWER

Columns, reactors, scrubbers & internals

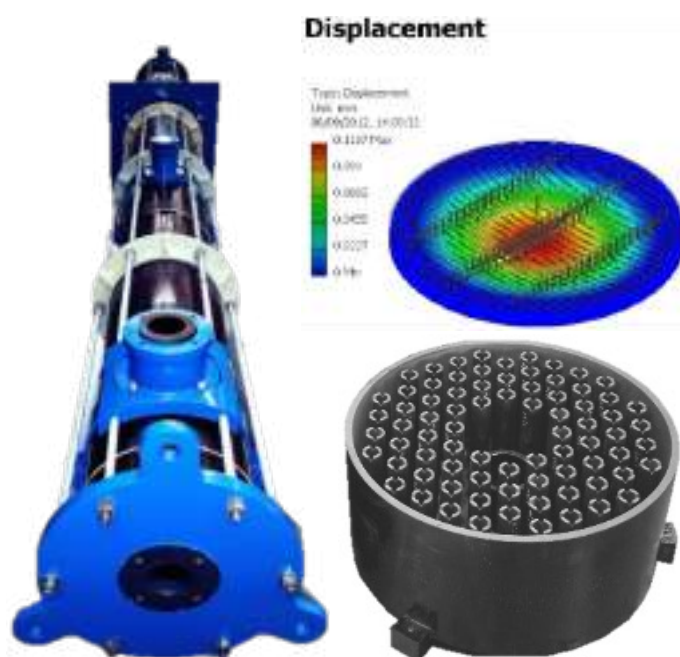
- Column for distillation, stripping and absorption
- Distributors, trays, packing support grids, mist eliminator
- Supports, dippipes for tantalum, graphite, fluoro lined and glass lined tower
- Available in GT_KELITE (+) / GT_CARB (+) / GT_FLON
- From 0.05 m³ to 10 m³
- Up to 500 °C, 10 barg incl. vacuum

In standard

- STRESS FREE®
- STABLE LOAD®

Optional

- HAMMER PROOF®



GT_CP

Special equipment for chemical reactions

- Reactors with /without thermosyphon, agitation, cooling / heating functions
- Storage tank for hot media
- Custom design, lab scale
- Outstanding corrosion resistance (GT_KELITE(+)) / GT_CARB+ / GT_FLON / GT_OXY_FLON)
- Up to 500°C and 10 barg

Silicium/Silicon Carbide (SiC)

Silicium carbide is a complement to impregnated graphite when oxidative media are not compatible with graphite or when erosion protection is required.

Graphite Technology propose 2 types of heat exchangers based on SiC material.

- GT_BLOC, cylindrical stacked blocks
- GT_TUBE, shell and tubes

We are using SiC single phase, pressureless sintered silicon carbide (SSiC).

Physical Properties

Property	Unit	Value
Silicon carbide content	%	> 99.5
Bulk density	g/cm ³	> 3.12
Grain size	μm	4 - 10
Vickers Hardness	kg/mm ²	2800
Three point bending strength	MPa	450
Elastic modulus	GPa	410 ± 10
Flexural strength	MPa.m ^{1/2}	3.8 ± 0.7
Thermal conductivity	W/m.K	120 ± 10
Thermal expansion coefficient (RT-1000°C)	10 ⁻⁶ /K	4.3



Corrosion Properties

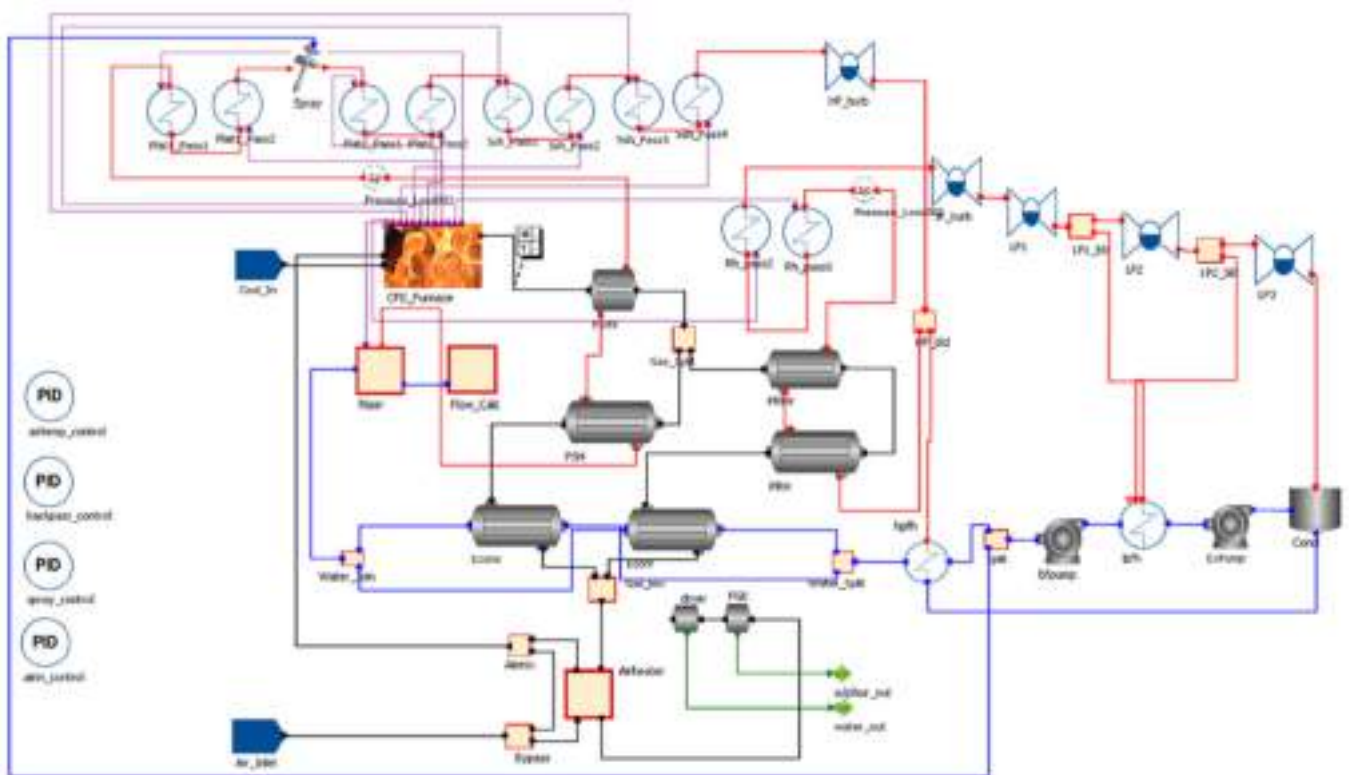
Property	Temp°C	Corrosion rate (mg/cm ² . year)
98% H ₂ SO ₄	100	0.98
54% HF	25	0.06
50% NaOH	100	1.25
45% KOH	100	0.04
70% HNO ₃	86	0.04
37% HCl	25	0.07
10% HF & HNO ₃	25	0.05
10% HF & HNO ₃	120	1.25

Process systems

Graphite Technology designs and manufactures process systems for the following applications ;

- Waste water and gas treatment.
- Concentration, crystallization by evaporation with hydrochloric acid, sulphuric acid, or phosphoric acid.
- Separation and purification of corrosive chemical products.
- Sulphuric acid dilution.
- Vacuum steam jet technology.

Our graphite equipment associated with technologies like MVR, TVR reduce greatly the operating costs thanks to energy saving and minimized capital costs.



H2SO4 + HF fluoro sulfuric acid concentration and separation

Based on GT_FLON_OXY and GT_VC, GT has developed two materials that are especially suitable for strong organic chemicals. Compared to traditional phenolic/furan impregnated resins, it has excellent corrosion resistance, dissolution resistance and swelling resistance.

We are designing system for purification or concentration of acids which content hydrofluoric acid. wOur unique combination of material allows us to propose unique solutions.

Combined with GT's unique OXY and VC treatment technology, it can protect the graphite itself and play an antioxidant role.

Quality Control

We have data for corrosion resistance covering most of corrosive media for various materials we are promoting.

For complex working conditions, GT provides samples free of charge for corrosion resistance in customer's factory or in GT's laboratory.

By detecting changes (mechanical properties, density, weight) in the physical properties of the sample, we will recommend the best material selection.

Contact with us to assess your media corrosion compatibility



Quality Management

Our Management of Quality complies with standards ISO 9000, A4 (China), ASME, AD-2000 and PED. We have full traceability of all our raw material, production steps, controls until the final equipment. We are committed to propose the highest satisfaction to customer needs.





Our Quality – Your Guarantee

Thanks to high level of competences of our employees and advanced processes, we can guarantee the best quality level for all our equipment. Every single component is going through the most extended quality controls.

After Sales Services

- Start-up & Operating assistance.
- Dedicated maintenance during lifetime of your units.
- Quick support - Field Service – Spare-Parts available.

We can replace and repair your existing graphite parts (cubic, blocks, shell and tubes) at competitive price and high quality.

Consultant Service

We develop individual solutions in close collaboration with our customers.

With our many years of experience, we are able to optimize your project in terms of materials selection and design.

Most of the time we are able to propose alternative optimized solution, with limited or even without piping modification.





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