Following information is necessary to design of CERALLEC™ SYSTEM

1 Gas Specification

- ☐ Quantity of process gas (Nm³/Hr)
- ☐ Moisture content (Nm³/Hr)
- ☐ Gas temperature (℃)
- ☐ Gas Pressure (Pa)
- ☐ Concentration of dust (g/Nm³)
- ☐ Dust type
- ☐ Size of dust grains (μm)
- ☐ Dust composition

2 Operating Condition

- ☐ Continuous or Batch versions (Operating/ Rest: /)

3 Specification Requirements

- ☐ Maximum permissible pressure-drop (loss)
- ☐ Outlet concentration of dust (g/Nm³)
- ☐ Noise regulations (Less than dB (A))
- ☐ Installation locations
- ☐ Installation spaces
- ☐ With or Without corrosive gas (HCL, SOx, HF etc.)

4 Utility

- ☐ Power AC V Hz
- ☐ Pressure air MPa
- ☐ Water MPa

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CERALLEC™ SYSTEM

Ceramic filter Dust collector for high-temperature gas

ecology energy electronics

NGK

What is CERALLEC™ SYSTEM?

CERALLEC™ SYSTEM can remove and collect solid particles from high temperature processes and provides the option to recover valuables from process gas.

Many industrial processes are facing the issue of treating high temperature gases, either to remove emissions to comply with regulations, or to separate valuable materials for increased profitability. The CERALLEC™ System enables the processing of high temperature gases by combining high filtration efficiency with a compact design.

Throwing away Valuables?

- Are products or other valuables released into the air via exhaust gas?
- Are valuable products being lost as sludge by processing with wet scrubbers?
- Are reusable gases being treated by a scrubber or released into the atmosphere?

CERALLEC™ more than 99% collection rate

- Removal of sub-micron solids from gas with a collection rate over 99%※1!
- High gas temperature operation of up to 600°C!
- Minimise or eliminate the need for gas cooling process steps!
- Highly resistant to corrosion due to our innovative ceramic filter material!
- Over 400 systems in operation today!

※1) The collecting rate depends on usage conditions of a gas entry

Cerallec™ System – The Dust Collector without the need for gas cooling

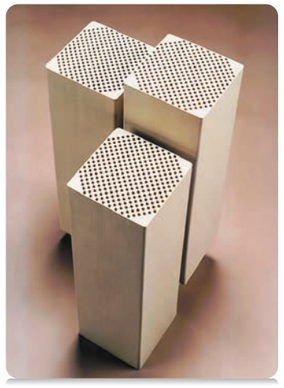
NGK has devised Cerallec™ System based on our unique know-how of automotive ceramic filters. The use of a honeycomb structure enables high collection performance with a compact design.

■Characteristics of CERALLEC™ SYSTEM

1 High collection efficiency
Collection rate over 99%

2 Sub micron Separation
Able to filter sub micron particles

3 Non-flammable
Ceramics are inherently incombustible



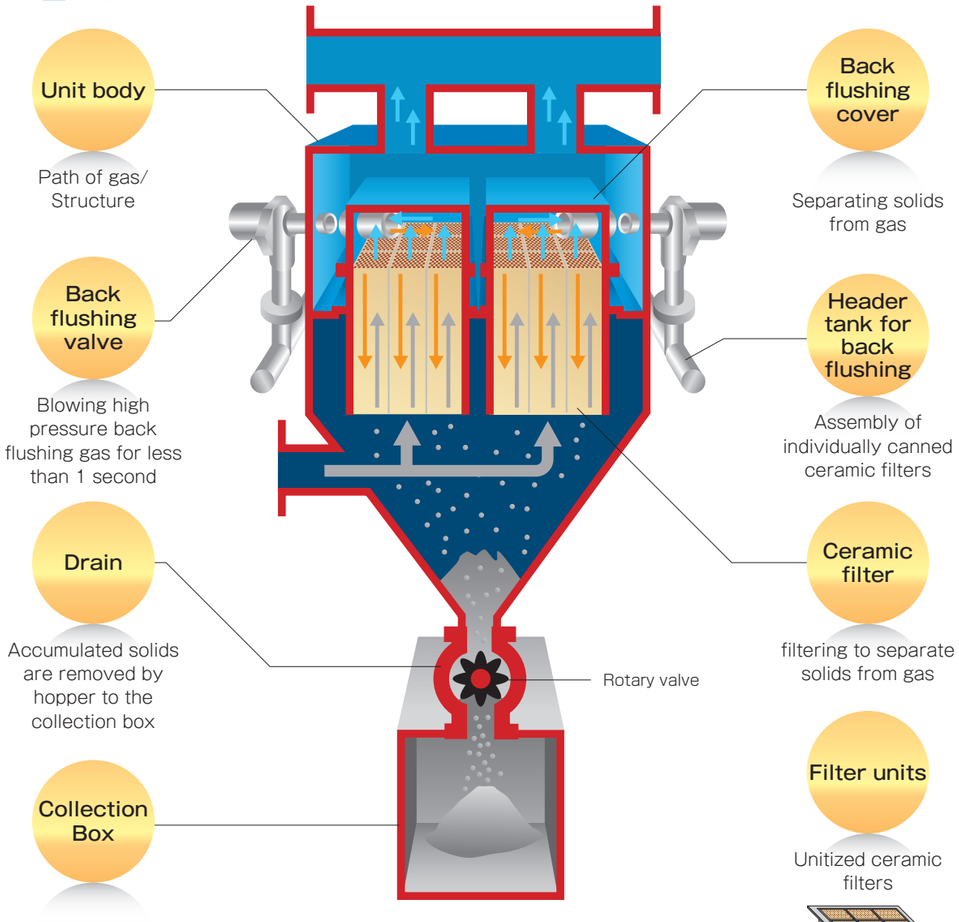
4 High corrosion resistance
Ceramics are less prone to corrosion than metals

5 Long-life
Filter has high strength and long life span without opening of mesh by back flushing

6 Compact design
The honeycomb design reduces the size of the device by approximately a quarter or even up to a half compared to a bag filter.

Figures and characteristics

■Names and Functions



The layout may vary with the type of application and the running conditions.
Customisations are available to meet your requirements

Characteristics of filter modules

		4mm	6mm
Material		Cordierite	
Heat resistance		~900℃	
Dimensions		150㎜×150㎜×500㎜	150㎜×150㎜×515㎜
Filtering area		4m²/filter	2.7m²/filter
Collecting particle size	1 layer	Approx.0.5μm	
	2 layers	—	Approx.0.1μm

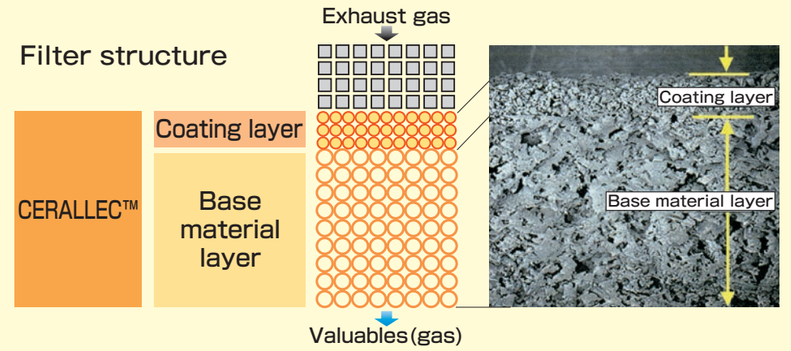
Unique technologies of NGK

The base ceramic filter structure is coated by fine-grain ceramic layer

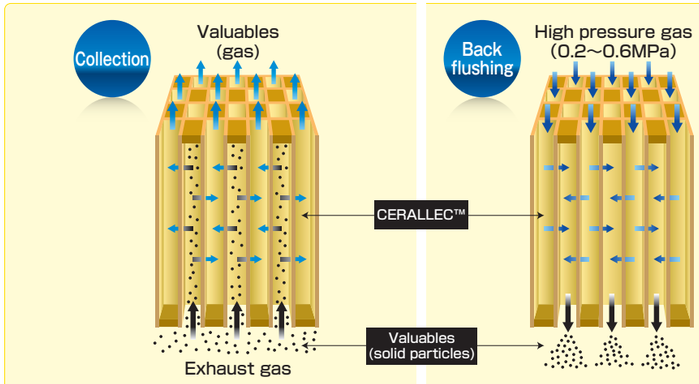
The CERALLEC™ SYSTEM is developed based on NGK´s unique know-how of ceramic materials. Derived from our HONEYCERAM technology for automobile exhaust gas treatment and our pharmaceutical water purifier, CERALLEC™ combines high surface area honeycomb technology and ultra-fine structured ceramic membranes for a compact design and high collection performance.

■Filtering mechanism

Cerallec™ system can remove solid particles from high temperature exhaust gas stream.



■Backflushing procedure



What is Back flushing? To prevent clogging, the ceramic filter is cleaned regularly by high pressure gas jets from the opposite side of the incoming exhaust gas. This results in high collection efficiency whilst reducing maintenance downtime.

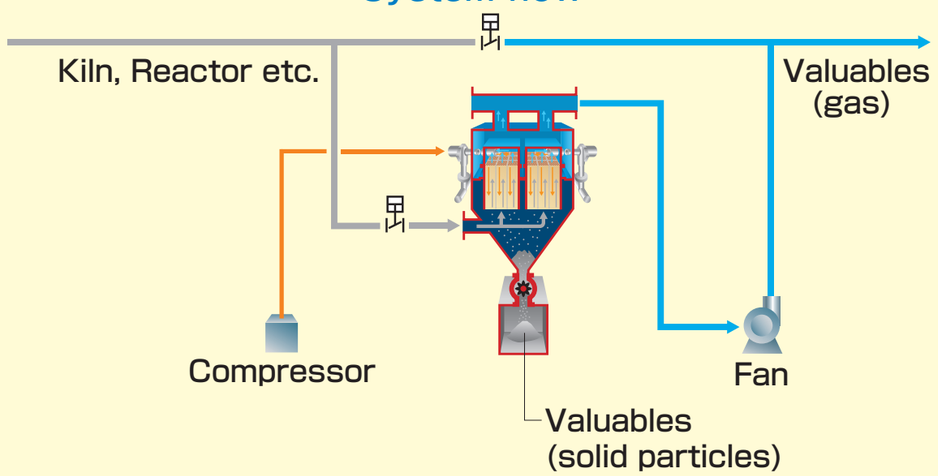
Examples of CERALLEC™ Implementation

Installation is available for a wide range of industrial processes

Diesel Engine	Chemical recycling	Silica Manufacturing
Optical fiber manufacturing	Activated Carbon manufacturing	Biomass field
Lithium ion Battery manufacturing	Universities & Research institutes	etc...

CERALLEC™ SYSTEM can turn losses into assets. Enabling hot gas filtration for a fast return on investment.

System flow



Comparison chart of dust collector

Dust Collector type	Dry Type			Dry type/ Wet type	Wet type
	CERALLEC™ SYSTEM	Bag filters	Cyclone	Electric dust collector	Scrubber
Separating limit (μm)	++	+	−	−	−
Collection rate (%)	++	++	−	+	−
Pressure loss (kPa)	−	+	−	++	++
Heat resistance (°C)	++	−	++	+	+
Installation space	++	−	++	+	−
Running costs	++	+	++	−	−
Maintainability	++	−	++	−	−
Characteristics	・Enabling filtration of micro particles ・Enabling high temperature gas ・Low maintenance frequency ・Easy filter unit replacement	・Inexpensive installation cost ・Requires frequent replacement due to mesh opening	・Inexpensive installation cost ・Maintenance free	・High volume processing ・Requires frequent replacement of electrodes due to dirt and corrosion	・Enabling filtration as well as chemical treatment ・Waste water disposal adding additional costs

According to NGK research.

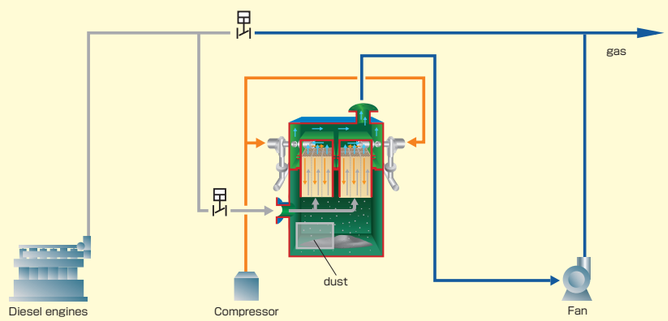
*Above comparison chart is based on common characteristics of each device, actual collecting rate and specific information of CERALLEC™ SYSTEM are indicated after presenting using conditions.
*Product specifications may be changed without prior notice.

What is the filtering system for black smoke exhausted from diesel engine?

CERALLEC™ SYSTEM resolves air pollution and environmental problems caused by black smoke (PM).

Exhaust gas from diesel engines includes hazardous substances causing health issues such as asthma or lung cancer. However, considering the challenges of decarbonisation within the transportation sector, Heavy-Duty diesel engines will still remain the backbone of the economy. With the high pressure from society to make them cleaner and more efficient, large testing facilities will also have to comply with more stringent regulations.

■System flow



What is the filtering system for valuable collecting on chemical manufacturing process

Example of collecting SiO2 and HCl

■Scrubber vs Cerallec™

【Scrubber】

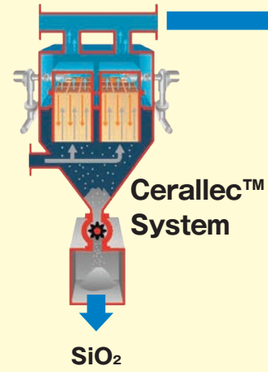
$SiCl_4, H_2, O_2$ ↓ SiO_2, HCl ➡ **Scrubber** ➡ **HCl + SiO_2Slurry** ➡ Disposal

Problem

●Need to dispose the slurry of HCl and SiO2.
=High disposal costs are required.

【Cerallec™】

$SiCl_4, H_2, O_2$ ↓ SiO_2, HCl



HCl •••• processing •••→ HCl

Solution

●Ability to collect SiO2 and HCl.
= Ability to use for customer's process or external sales.

■Bag filter vs Cerallec™

【Bag filter】

220°C

Kiln ➡ Bag filter

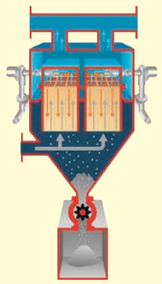
Cooling gas

Problem

●Large volumes of Cooling gas are needed.
·Duct for gas will be thick.
·System size will be large due to the high gas volume.
● Bag filter has risk to be burned out.

【Cerallec™】

Kiln ➡



450°C

Solution

●A cooling gas is unnecessary.
·Duct for gas will be thin.
·System size is compact because the filter with honeycomb structure has large filtration area.
Installation area is 1/5~1/2 compared to bag filter.
●Ceramic filter is Non-flammable, so there is no risk of fire.

Examples of applications

1 Lithium Ion Battery Manufacturing process

Enables the collection of valuable materials such as nickel and cobalt from exhaust gas for re-utilisation.

2 Cooperation with the public, private and academic sectors

New fields

Supporting development

Soot prevention measures in biomass power generation market etc.(Refer to page 4 - 7)

3 Biomass Gasification

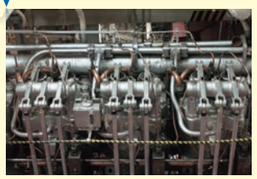
Enables the collection of unburned biomass from high temperature exhaust gas to prevent clogging or fouling of the process.

Recovery of valuables

Removal of black smoke or dust

Others

7 Diesel Engine

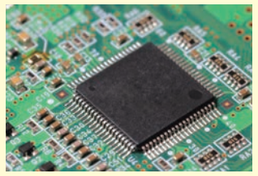


Enables the removal of black carbon from exhaust gas to prevent smoke.

6 Chemical Recycling

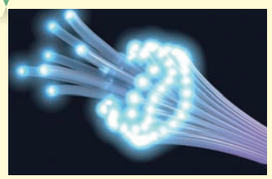
Enables the collection of dust from the exhaust gas of pyrolysis processes.

5 Silica for semiconductor sealing agents manufacturing process



Enables the collection of the product (silica) from high temperature gas in the manufacturing process.

4 Optical fibre manufacturing



Enables the collection of SiO2 and HCl from the exhaust gas and then utilise them on the optical fibre manufacturing process.