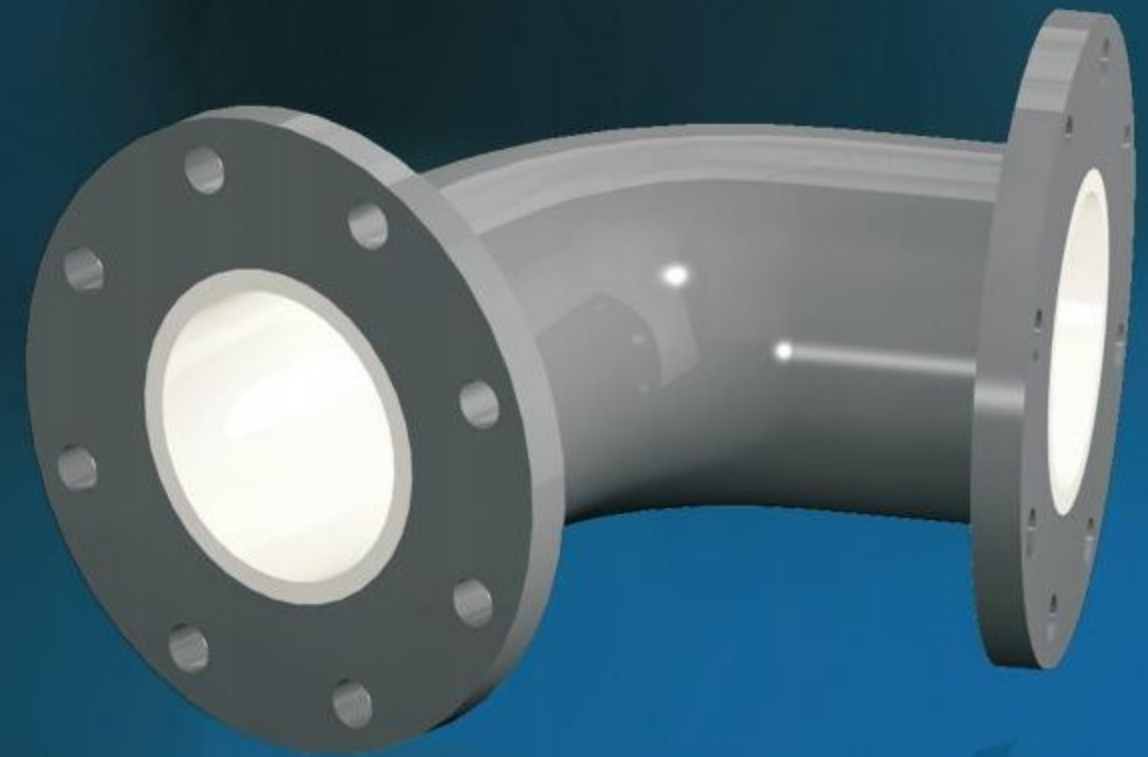


# KOWOY®

## Ceramic Pipe



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Note: The company reserves the right to modify product technical parameters without prior notice due to continuous improvements in product performance.

## Introduction to Wear-Resistant Ceramic Pipe

### Product Overview

Kingway Science & Technology Co., Ltd. was established in 1998, specializing in the research and development production of ceramic valves, ceramic wear-resistant pipes, have been widely used in China domestic and abroad.



KOWOV ceramic wear-resistant pipelines are composed of structural ceramic pipes and seamless steel pipes. The ceramic pipes are firmly bonded to the seamless steel pipes using a heat distribution process or a specialized adhesive for structural ceramics.

KOWOV ceramic wear-resistant pipelines are molded as a single unit, providing high strength and toughness. They offer high-temperature resistance and aging resistance, ensuring long-term operation under conditions ranging from **-50°C to 500°C**.

### Performance Features

- 1. Low flowing Resistance**
  - The smooth ceramic surface reduces flow resistance, improving efficiency
- 2. Superior Wear Resistance**
  - Structural ceramics have 266 times the wear resistance of manganese steel and 171.5 times that of high-chromium cast iron.
  - Ceramic-lined elbows significantly reduce equipment wear in powder processing systems.
  - Based on field experience, the service life is at least 10 years, reducing maintenance frequency and costs.
- 3. Extended Service Life**
  - The steel-ceramic layer consists of high-performance structural ceramics with neutral properties.
  - Highly resistant to acids, alkalis, and seawater corrosion, with anti-scaling properties, ensuring a longer service life.
- 4. Excellent Temperature Resistance**
  - The structural ceramic has a stable crystalline structure, allowing composite pipes to operate continuously between -50°C to 500°C.
  - The thermal expansion coefficient of  $6-8 \times 10^{-6} / ^\circ\text{C}$  is about half that of steel pipes, providing excellent thermal stability.

### Application

- 1. Power Plants** – Limestone slurry transportation
- 2. Steel Mills** – Coal powder and fly ash transportation
- 3. Mining Industry** – Slurry and tailings transportation
- 4. Silicon Chemical Industry** – Silicon powder transportation
- 5. Chemical Plants** – Acid and alkali slurry transportation
- 6. Coal Chemical Industry** – Ash water, black water, coal slag, and dry coal powder transportation
- 7. Fertilizer Industry** – Granular fertilizer and crystal transportation
- 8. Coal Washing Plants** – Coal slurry and coal sludge transportation
- 9. Metallurgical Industry** – Slag discharge and boiler ash removal
- 10. New Energy** – Lithium carbonate and lithium iron phosphate transportation
- 11. Environmental Protection** – Wastewater discharge and solid waste treatment



## KOUOV<sup>®</sup> Ceramic Pipe Model Compilation Method

### KWCP-WZ-WT -DN\* L - S - PN

① ②③ ④ ⑤ ⑥ ⑦

- ① KWCP-Ceramic Pipe
- ② W -Carbon steel ; P - 3 04 Stainless Steel ; R - 3 1 6 Stainless Steel
- ③ Z- Zirconia Ceramic; A- Alumina Ceramic; C -Silicon Carbide Ceramic; N- Silicon Nitride Ceramic
- ④ ZG- Straight Pipe; WT- Elbow; ET- Equal Tee; RT-Reducing Tee; EC -Equal Cross ; RC -Reducing Cross ; CR-Concentric Reducer; ER-Eccentric Reducer; Sp1-Special Pipe Fittings
- ⑤ DN -Nominal diameter; L-Length or angle;
- ⑥ Flange Execution Standard
- ⑦ PN -Pressure Rating

Note: The special pipe fittings are non-standard diameter, and the shape can be designed according to the requirements.  
Example 1:

A 90° elbow with silicon carbide ceramic lining, carbon steel outer shell, DN80, and PN16, using HG/T 20592-2009 flange standard: DN80 PN16, using Flange HG/T20952-2009 standard:

KWCP-W-C-WT-DN80\*90°-HG/T20592-16

Example 2:

A 200mm-long straight pipe with zirconia ceramic lining, 304 stainless steel outer shell, DN80, and Class 150, using HG/T 20592-2009 flange standard:

KWCP-P-Z-ZF-DN80\*200-HG/T20592-150

### Product type code

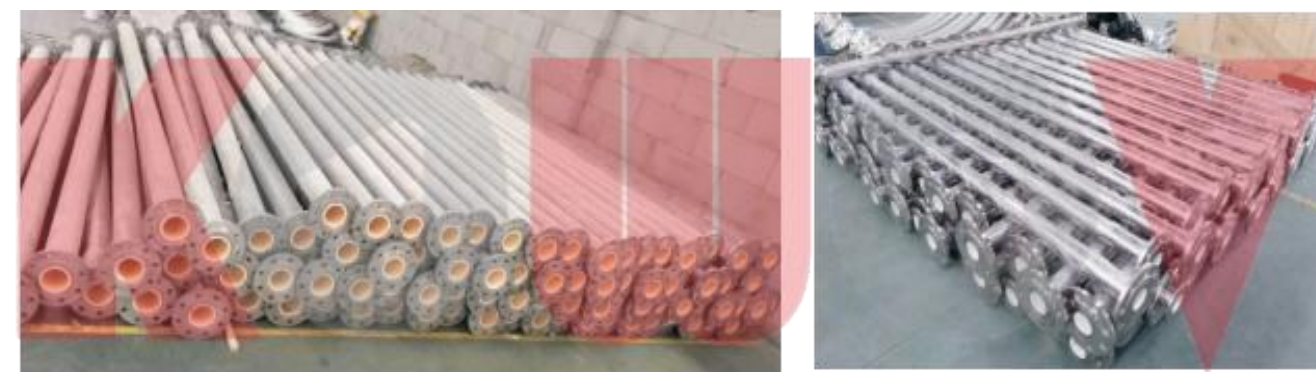
Product Type	Code	Marking Method
Both Ends Fixed Flange	ZG	KWCP-WZ-ZG-DN*L-Flange standard No.- Pressure Rating
45° elbow	WT	KWCP-WZ-WT-DN*45°-Flange standard No.-Pressure Rating
90° elbow	WT	KWCP-WZ-WT-DN*90°-Flange standard No.-Pressure Rating
Equal Tee	ET	KWCP-WZ-ET-DN-Flange standard No.-Pressure Rating
Reducing Tee	RT	KWCP.WZ-RT-DN*Small end NS DN 1-Flange standard No.-Pressure Rating
Equal Cross	EC	KWCP-WZ-EC-DN-Flange standard No.-Pressure Rating
Reducing Cross	RC	KWCP-WZ-RC-DN*Small end NS DN 1-Flange standard No.-Pressure Rating
Concentric Reducer	CR	KWCP-WZ-CR-DN*Small end NS DN 1Flange standard No.-Pressure Rating
Eccentric Reducer	ER	KWCP-WZ-RE-DN*Small end NS DN 1Flange standard No.-Pressure Rating

## KOUOV<sup>®</sup> Model & Dimensions of Lined Ceramic Pipes

The structural form & main size of Ceramic Composite Lined Steel Pipe mm

Diagram	DN	Common steel Pipe wall thickness	Liner wall thickness	Gap between Ceramic Layer and outer metal pipe	Optional length L
	25	3 ~ 5	Refer to the Ceramic inner liner thickness table	Refer to the Ceramic layer and outer metal pipe gap table	200 ~ 500
	32	3 ~ 5			200 ~ 500
	40	3 ~ 5			200 ~ 500
	50	3 ~ 5			200 ~ 500
	65	3 ~ 5			200 ~ 500
	80	4 ~ 6			200 ~ 500
	100	4 ~ 6			200 ~ 500
	125	4 ~ 6			200 ~ 500
	150	4 ~ 6			200 ~ 500
	200	5 ~ 8			200 ~ 500
	250	5 ~ 8			200 ~ 500
	300	6 ~ 10			200 ~ 500

The wall thickness T of commonly used carbon steel pipes in this table has a pressure rating of  $\leq 5.0\text{Mpa}$ , while the outer diameter D and wall thickness T of other pressure ratings are determined through negotiation between the purchaser and the manufacturer





**KOUOV® Model & Dimensions of Lined Ceramic Pipes**

**Structural ceramic lining 90° elbow, 45° elbow structural form and main size** Unit: mm

Diagram	DN	Liner wall thickness	Gap between Ceramic Layer and outer metal pipe	90° Elbow		45° Elbow	
				R	L	R	L
<p>Liner Ceramic 90° Elbow</p>	25	Refer to the Ceramic inner liner thickness table	Refer to the Ceramic layer and outer metal pipe gap table	98	44	109	
	32			108	51	123	
	40			115	57	138	
	50			125	64	155	
	65			137	76	183	
	80			144	76	183	
	100			156	102	246	
	125			173	114	275	
	150			191	127	307	
	200			220	140	338	
<p>Liner Ceramic 45° Elbow</p>	250	257	165	398			
	300	285	190	459			



**KOUOV® Model & Dimensions of Lined Ceramic Pipes**

**Structural ceramic lining of Equal tee, Reducing Tee and main size of the tee** Unit : mm

Diagram	DN	Liner Wall Thickness	Gap between Ceramic Layer and outer metal pipe	Equal Tee		Reducing Tee		Small nominal diameter DN1	end
				L	H	L	G		
<p>Liner Ceramic Equal Tee</p>	25	Refer to the Ceramic inner liner thickness table	Refer to the Ceramic layer and outer metal pipe gap table	196	98	196	98	20	
	32			216	108	216	108	25	
	40			230	115	230	115	25, 32	
	50			250	125	250	125	25, 32, 40	
	65			274	137	274	137	25, 32, 40, 50	
	80			288	144	288	144	25, 32, 40, 50, 65	
	100			312	156	312	156	25, 32, 40, 50, 65, 80	
	125			346	173	346	173	25, 32, 40, 50, 65, 80, 100	
<p>Liner Ceramic Reducing Tee</p>	150	382	191	382	191	25, 32, 40, 50, 65, 80, 100, 125			
	200	440	220	440	220	32, 40, 50, 65, 80, 100, 125, 150			
	250	514	257	514	257	40, 50, 65, 80, 100, 125, 150, 200			
	300	570	285	570	285	50, 65, 80, 100, 125, 150, 200, 250			



## KOVOV® Model & Dimensions of Lined Ceramic Pipes

Structural Ceramic Equal cross. Reducing Cross structural form dimension: mm

Diagram	DN	Liner wall thickness	Gap between Ceramic Layer and outer metal	Equal Tee		Reducing Tee		
				H	L	G	Small end nominal DN1	
<p>Liner Equal cross</p>	25	Refer to the Ceramic inner liner thickness table	Refer to the Ceramic layer and outer metal pipe gap table	196	98	196	98	20
	32			216	108	216	108	25
	40			230	115	230	115	25, 32
	50			250	125	250	125	25, 32, 40
	65			274	137	274	137	25, 32, 40, 50
	80			288	144	288	144	25, 32, 40, 50, 65
	100			312	156	312	156	25, 32, 40, 50, 65, 80
	125			346	173	346	173	25, 32, 40, 50, 65, 80, 100
	150			382	191	382	191	25, 32, 40, 50, 65, 80, 100, 125
	200			440	220	440	220	32, 40, 50, 65, 80, 100, 125, 150
<p>Liner Reducing cross</p>	250	514	257	514	257	40, 50, 65, 80, 100, 125, 150, 200		
	300	570	285	570	285	50, 65, 80, 100, 125, 150, 200, 250		

## KOVOV® Model & Dimensions of Lined Ceramic Pipes

Structural ceramic-lined concentric and eccentric special-shaped pipes form dimension: mm

Diagram	DN	Small end nominal DN1	Liner wall thickness	Gap between ceramic and metal	Concentric pipe		Eccentric pipe	
					L	L	a	
<p>Ceramic-lined Eccentric Pipe</p>	25	20	Refer to the Ceramic inner liner thickness table	Refer to the Ceramic layer and outer metal pipe gap table	51			
	32	25			51	51	3.5	
	40	25			64	64	7.5	
		32			64	64	4	
	50	25			76	76	12.5	
		32			76	76	9	
	65	40			76	76	5	
		32			89	89	16.5	
	80	40			89	89	12.5	
		50			89	89	7.5	
100	40	89	89	20				
	50	89	89	15				
125	65	89	89	7.5				
	50	102	102	25				
150	65	102	102	17.5				
	80	102	102	10				
200	65	127	127	30				
	80	127	127	22.5				
250	100	127	127	12.5				
	125	140	140	35				
300	100	140	140	25				
	125	140	140	12.5				
Ceramic-lined Concentric Pipe	250	100	152	152	50			
		125	152	152	37.5			
300	150	152	152	25				
	125	178	178	62.5				
300	150	178	178	50				
	200	178	178	25				
300	150	203	203	75				
	200	203	203	50				
300	250	203	203	25				



**KOWOV® Ceramic pipe wall fitting thickness tolerance table**

Structural ceramic, liner wall thickness Unit: mm

Inner DΦ	20≤Φ≤ 50	50< Φ≤ 100	100< Φ≤ 150	150< Φ≤ 250	250< Φ≤ 350
Total T	5~ 10	10~ 16	16~ 17	17~ 22	22~ 30
Tolerance	± 0.2	± 0.5	± 0.5	± 0.5	± 1

Remark :Total T is wall liner ceramic T and wall steel pipe T

Main dimension tolerance of straight pipe Unit: mm

DN	Straight pipe L				
	Min -200	200-500	500-1000	1000- 2000	2000- 3000
25 -100	± 0.5	± 1	± 1.5	± 2.0	± 2.5
125-300	± 1	± 1.5	± 2.0	± 2.5	± 3.0

Main size tolerance of pipe fittings Unit: mm

DN	90° elbow	45° elbow		Tee Cross		Reducing pipe L	
	R	L	R	L	H	150、200	250、300
25-100	±2.0	±2.0	±2.0	±1.5	±1.5	±1.0	±1.5
125-300	±2.5	±2.5	±2.0	±2.0	±2.0	±1.5	±2.0

Gap size between ceramic layer and outer metal pipe Unit: mm

Grade	Straight	Elbow
A	0.5	0.5-1
B	1-1.5	1.5-2
C	2-2.5	2.5-3

**KOWOV® Material Properties of Ceramic Pipe Fittings**

**Alumina (Al<sub>2</sub>O<sub>3</sub>) Structural Ceramic**

Aluminum oxide (Al <sub>2</sub> O <sub>3</sub> )					
Index	Unit	95% Al <sub>2</sub> O <sub>3</sub>	99% Al <sub>2</sub> O <sub>3</sub>	99% Al <sub>2</sub> O <sub>3</sub>	Testing Standard
Density	g/cm <sup>3</sup>	≥3.7	3.8	3.85	GB/T 25995
Hardness	HRA	≥85	88	89	GB/T 230.1
	HV	≥950	1200	1300	GB/T 16534
Flexural Strength	Mpa	≥350	400	450	GB/T 4741
Compressive Strength	Mpa	≥2000	2200	2300	GB/T 4740
Thermal Expansion Coefficient	×10 <sup>-6</sup> /°C	≥7.8	8	8	GB/T 16535
Fracture Toughness	MPa·m <sup>1/2</sup>	≥4	5	5.5	GB/T 23806
Thermal Conductivity	W/m·K	22.4	25	25	GB/T 10295
Operating Temperature	°C	<1250	<1500	<1500	/
Thermal Shock Temp.	°C	50	50	50	/





**KOYO<sup>®</sup> Material Properties of Ceramic Pipe Fittings**

**Common Silicon Carbide (SiC) Structural Ceramics**

Index	unit	Reaction-Sintered SiC	Unpressed-Sintered SiC			Thermally pressed sintered SiC	Testing Standard
		RB SiC	SSiC-A	SSiC-B	SSiC-C	HP SiC	
Density	g/cm <sup>3</sup> ≥	3.06	3.08	3.2	2.65	3.15	GB/T 25995
Hardness	HRA ≥	90	92	90	\	93	GB/T 230.1
	HV ≥	1400	1600	1400	\	1800	GB/T 16534
Flexural Strength	Mpa ≥	280	400	470	120	550	GB/T 4741
Compressive Strength	Mpa ≥	2000	2200	2200	1500	2200	GB/T 4740
Thermal Expansion Coefficient	× 10 <sup>-6</sup> /°C	4.0	4.0	4.2	4.0	4.0	GB/T 16535
Fracture Toughness	MPam <sup>1/2</sup> ≥	4.0	3.6	4	\	3.2	GB/T 23806
Thermal Conductivity	W/m · K	45-80	80-90	50	100	100	GB/T 10295
Operating Temperature	°C	<1500	<1500	<1500	<1500	<1500	/
Thermal Shock Temperature	°C	75	75	75	75	75	/

SSiC-A: Solid-state sintered silicon carbide with boron and borides added.  
 SSiC-B: Liquid-phase sintered silicon carbide with alumina and yttrium aluminum garnet (YAG)  
 SSiC-C: Silicon carbide-graphite composite material with added graphite.

**KOYO<sup>®</sup> Material Properties of Ceramic Pipe Fittings**

**Common Silicon Carbide (SiC) Structural Ceramics**

Index	unit	Technical Requirements		Testing standard
		Isostatic Pressing	Mold Pressing	
Density	g/cm <sup>3</sup> ≥	3.3	3.2	GB/T 25995
Hardness	HRA ≥	89	88	GB/T 230.1
	HV ≥	1300	1200	GB/T 16534
Flexural Strength	Mpa ≥	900	700	GB/T 4741
Compressive Strength	Mpa ≥	2800	2800	GB/T 4740
Thermal Expansion Coefficient	× 10 <sup>-6</sup> /°C	3.2	3.2	GB/T 16535
Fracture Conductivity	MPam <sup>1/2</sup> ≥	6.0	7.0	GB/T 23806
Thermal Conductivity	W/m · K	20	20	GB/T 10295
Operating Temp.	°C	<1500	<1500	/
Thermal Shock Temp.	°C	200	200	/

**Zirconia (ZrO<sub>2</sub>) Structural Ceramics**

Index	unit	Y-TZP	Ce-TZP	Mg-PSZ	Testing standard
Density	g/cm <sup>3</sup> ≥	6	5.45	5.7	GB/T 25995
Hardness	HRA ≥	87	87	86	GB/T 230.1
	HV ≥	1150	1150	1000	GB/T 16534
Flexural Strength	Mpa ≥	1100	700	800	GB/T 4741
Compressive Strength	Mpa ≥	2000	1800	1800	GB/T 4740
Thermal Expansion Coefficient	× 10 <sup>-6</sup> /°C ≥	10	9.6	9.2	GB/T 16535
Fracture Toughness	MPam <sup>1/2</sup> ≥	10	8	8	GB/T 23806
Thermal Conductivity	W/m · K	2.5	2.4	2	GB/T 10295
Operation Temperature	°C	<160	<1000	<1000	/
Thermal Shock Temperature	°C	87	87	87	/





**KOUOV® Corrosion Resistance of Ceramic Pipe Fittings**

**Material Compatibility with Common Chemicals**

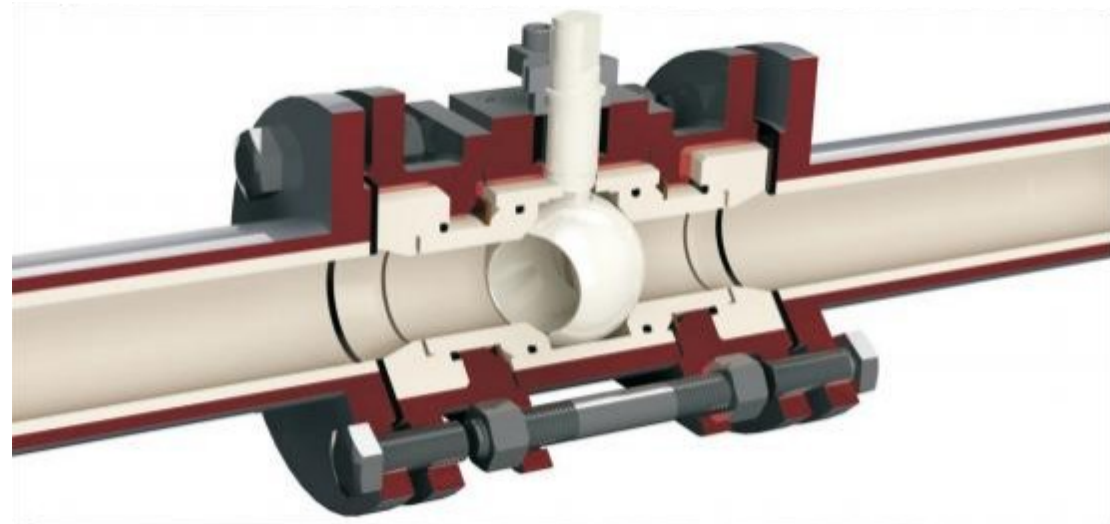
Media	Temp. °C	99.9%Al <sub>2</sub> O <sub>3</sub>	SiC	ZrO <sub>2</sub>	Si <sub>3</sub> N <sub>4</sub>
20% HCL	60	A	A	A	B
20% HCL	95	A	A	A	C
90% H <sub>2</sub> SO <sub>4</sub>	60	A	A	A	A
60% H <sub>2</sub> SO <sub>4</sub>	95	A	A	A	B
60% H <sub>3</sub> PO <sub>4</sub>	60	A	A	A	C
60% H <sub>3</sub> PO <sub>4</sub>	95	A	A	A	C
10% HF	60	B	A	C	A
46% HF	95	C	A	C	C
60% HNO <sub>3</sub>	60	A	A	A	C
60% HNO <sub>3</sub>	95	B	A	A	C
30 % NaOH	60	B	A	A	B
30 % NaOH	95	B	A	B	C

**Legend:**

A = < 0. 1mmg/c m<sup>2</sup>/day/, Negligible or no corrosion, is recommended.

B = < 0. 1-0. 3mmg/c m<sup>2</sup>/day/ Minor or minimal corrosion, use with caution.

C > 0. 3mmg/c m<sup>2</sup>/day/ Significant corrosion is not recommended.



**KOUOV® Ceramic Pipe & Fittings Applications in Various Industries**

**Coal chemical industry**

Black water. Ash water. Coal slurry. pulverized coal. sewage. salt water...



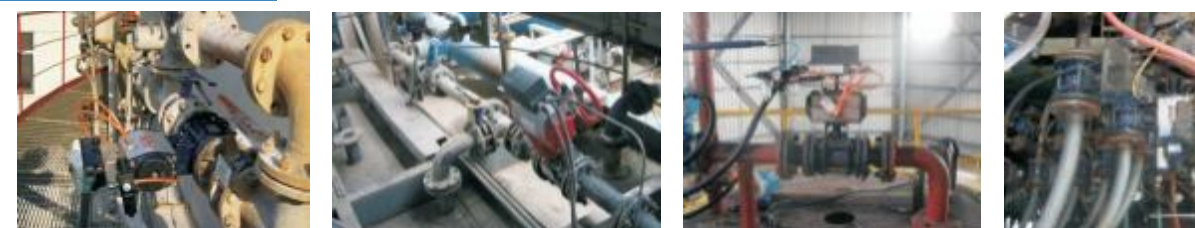
**Silicone chemical industry**

Silicon powder delivery. residual liquid



**Power / steel plant**

Lime slurry. Ammonium sulfur slurry. Pulverized coal



**Casting /metallurgy**

Type sand transportation, tailings backfilling, slurry transport, acid slurry...

