

FCBV

Ceramic Ball Valves

For Extreme Corrosive & Abrasive Applications



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FOYO FCBV series forged ceramic ball valve uses ceramics ball and lining. When applying to strong acid, strong alkali, slag, powder, grain, slurry, and other high-temperature, high corrosive and abrasive working condition, our ceramic ball valves have stable working performance and longer service life than metal seated ball valves no matter as on-off valves or flow control valves.

FCBV series forged ceramic ball valve is three-pcs body design with flange connection. Material of body could be carbon steel or stainless steel according to working conditions or per customers' requirements. All wet parts include ball, seat and lining are all made of structure ceramics so that medium will not be in touch with body directly and valve body will not be corroded or abraded.

Pressure Range

PN10,PN16,PN25,PN40,PN63,PN100;
ANSI CL150, CL300, CL600; JIS 10K, 20K

Size Range

DN15~DN300/ANSI 1/2"~12"

Design Standard

Flange Dim. EN1092-1, ASME B16.5, JIS B2220
F-to-F Dim. ASME B16.10, EN558-1
Inspection&Test API 598

Features

Three pieces design of FCBV series forged ceramic ball valves could make sure of flexible assembling dimensions. Flange dimensions and face to face of valves could be designed per customers' special requirements, so that ceramic ball valve could be assembled on the pipeline without any modification of current pipe and valve assembling cost.

All trims of valves (including ball, seats, bushing, lining and stem, etc) have been precisely designed and machined to make sure that body of valve will not be in touch with medium directly and body of valve will not be corroded or abraded by medium.

Sealing faces of ceramic ball and ceramic seats have been polished by advanced technique and machines. After precise grinding, all leakage level of FCBV series forged ceramic ball valves could reach ANSI/FCI 70-2 Class VI(zero leakage).

Actuation of FCBV series valves includes lever, bare stem, worm gear, pneumatic actuator and electric actuator, etc. Mounting pad is designed according to ISO 5211.



Corrosion Resistance

>99%Al₂O₃, ZrO₂, Si₃N₄, SiC are made by Cold isostatic pressing molding and high sintering. All these ceramics will not interact with almost all organic solvent and inorganic chemical medium (except hydrofluoric acid), so ceramics will not contaminate medium. Solid Tungsten carbide(STC) has good mechanical performance and thermal-shock performance, which is suitable for high temperature, high pressure and high abrasive working conditions.

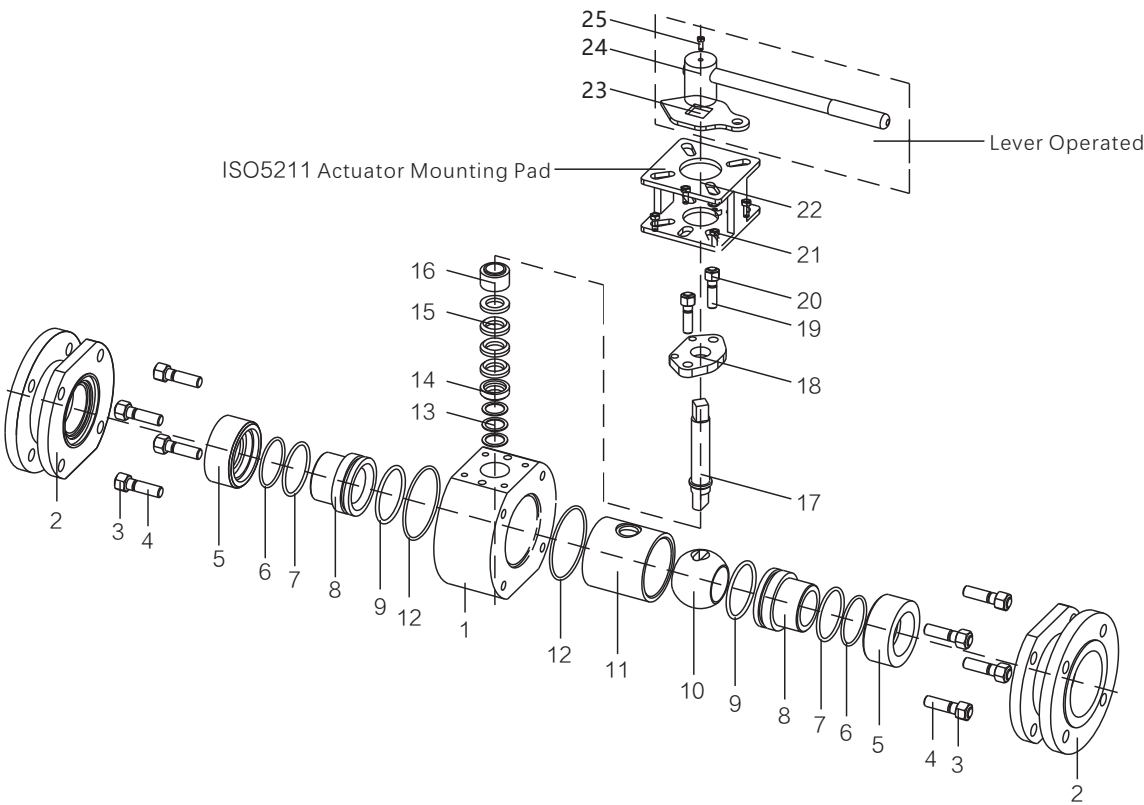
Structure ceramics has wonderful chemical stability, which makes sure that physical property and chemical property of ceramic trims will not change after long times of usage in all kinds of strong acid and strong alkali.

FOYO FCBV series forged ceramic ball valves have showed great performance in various severe highly corrosive working conditions of steel mill, metallurgy, petro-chemical, mining, coal-fired power plant, paper&pulp, polysilicon, etc.

FOYO's experienced engineers will select the most suitable material and solution for different working conditions.



Exploded View



Parts List

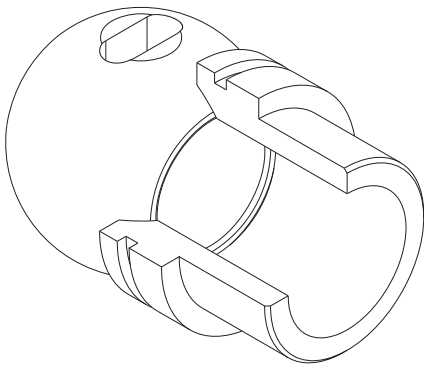
No.	Name	Material
1	Body	A105N, F304,F316,F316L
2	Adapter	A105N, F304,F316,F316L
3	Nut	A194-2H/8
4	Bolt	A193-B7/B8
5	Adapter Lining	Ceramics
6	O-Ring	FKM/VMQ
7	O-Ring	FKM/VMQ
8	Seat	Ceramics
9	O-Ring	VITON/VMQ
10	Ball	Ceramics
11	Bushing	Ceramics
12	O-Ring	VITON/VMQ
13	Gasket	RPTFE

No.	Name	Material
14	Sleeve	F304/F316L/Hastelloy C276
15	Packing	PTFE/Graphite
16	Gland	F304/F316/F316L
17	Stem	17-4PH/F304/F316L/Hastelloy C276
18	Gland Flange	ASTM A351 CF8
19	Bolt	ASTM A193-B7/B8
20	Nut	ASTM A194-2H/8
21	Bolt	SS304
22	Yoke	ASTM A351 CF8
23	Stopper	SS304
24	Lever	AISI 1045/F304
25	Bolt	SS304

Note: Material of parts may be variable against different applications, Please contact FOYO for professional proposal.

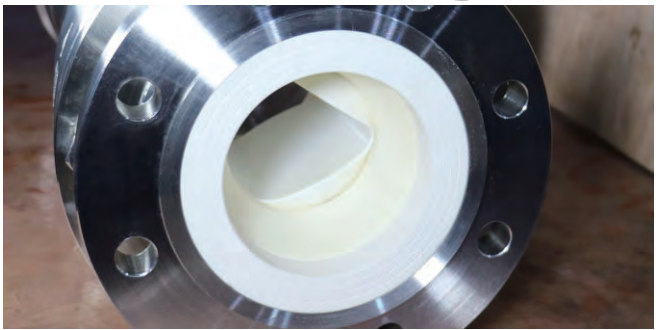
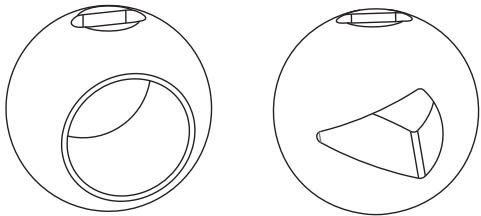
Ceramics-to-Ceramics Spherical Sealing

The surface roughness of Spherical seal between ceramic ball and seat is Ra0.1~0.2. Meanwhile High hardness and self-lubricating performance of structure ceramics will make sure that seat sealing of valve could reach zero leakage (Class VI). Open and close torque of ceramic ball valves is much smaller than metal sealing ball valve and soft sealing ball valve with same size and pressure, which avoid cracked ball cause by too high torque.



Round and V-Port Ball

FOYO FCBV series forged ceramic ball includes Round-port and V port. Generally, Round port ball valves are used as shut-off valves; V port ball valves are used as flow control valves. V port ball has equal percentage flow characteristic. If precise and stable control performance is required in any application, equal percentage V-port ceramic ball valve is the best choice. Meanwhile, V port ball could cut off solids, fibers in the medium and clean sealing face by itself.

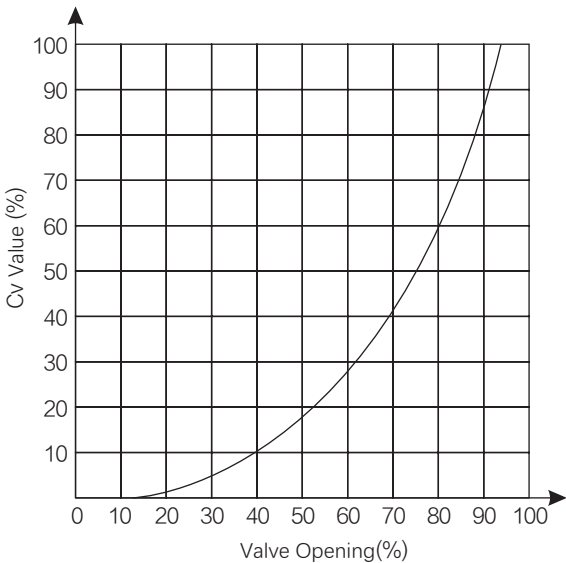


Cv Values

SIZE	Cv max.	
	O-Port	V-Port
1/2"	12	8
3/4"	18	12
1"	18	12
1 1/4"	42	24
1 1/2"	54	31
2"	140	120
2 1/2"	170	145
3"	325	160
4"	650	320
5"	1100	420
6"	2000	610
8"	2300	1200
10"	3600	—
12"	3600	—



Cv Curve for V-port Ceramic Ball Valve



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Physical Parameter of Ceramics

Material Item	Unit	>99% Al ₂ O ₃	ZrO ₂	Si ₃ N ₄	SSiC	STC
Bulk Density	g/cm ³	3.9	6.0	3.3	3.2	14
Flexural Strength	Mpa	310	1000	1020	540	3100
Elastic Modulus	Gpa	360	200	300	430	680
Hardness	HRA	88	86	90	92	86
Max. Temp.	°C	1750	1500	1000	1650	1000
Linear Expansion Coefficient	10 ⁻⁶ /°C	7.2	10.5	2.8	3.7	9.6

Corrosion Resistance of Ceramics

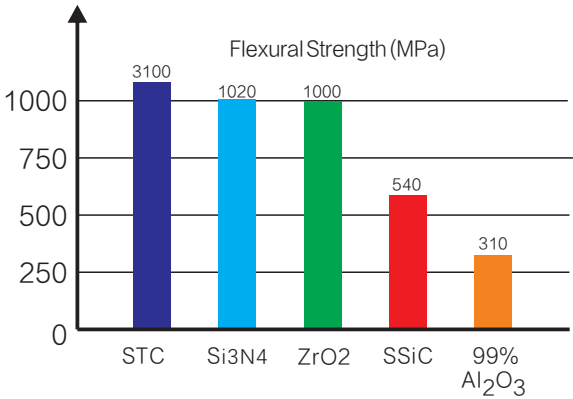
Comparing with other mostly metal and non-metal materials, 99%Al₂O₃, ZrO₂, Si₃N₄ and SSiC used for FOYO ceramic ball valves have better anti-corrosive property when applying for mostly majority strong acid and alkalis. Experienced FOYO engineers would love to choose mostly suitable ceramic material based on your specific working conditions.

Corrosion Resistance Comparison					
Medium	Temp.	Al ₂ O ₃ >99%	ZrO ₂	Si ₃ N ₄	SSiC
20%HCL	60°C	A	A	B	A
20%HCL	90°C	A	A	C	A
60%H ₂ SO ₄	60°C	A	A	A	A
60%H ₂ SO ₄	90°C	A	A	B	A
10%HF	60°C	B	C	C	A
50%HF	90°C	C	X	X	A
60%HNO ₃	60°C	A	A	C	A
60%HNO ₃	90°C	B	A	C	A
30%NaOH	60°C	A	A	B	A
30%NaOH	90°C	B	B	C	A

- A-Negligible or no corrosion, recommended for valve use
B-Little or Slight corrosion, fitness for valve use
C-Significant corrosion, not recommended for valve use
X-Violent corrosion, not allowed for valve use

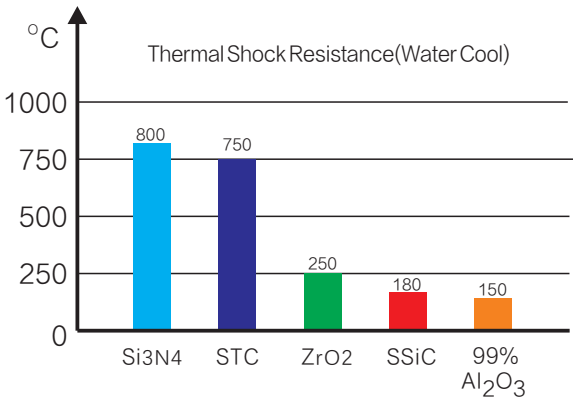
Mechanical Properties

Mechanical properties of ceramics are much different from metal material. High Pressure resistance of ceramics is much better than metal material, however tensile and flexural strength is not so good as metal material. Because of sensitive of mechanical shock, during assembling and usage, it will be best to avoid mechanical shock. In terms of Mechanical properties, Solid tungsten carbide (STC) are much better than other ceramics materials; Si₃N₄ and ZrO₂ are worse than STC, while 99%Al₂O₃ and silicon carbide (SSiC) are worse than Si₃N₄ and ZrO₂. For ceramic ball valves, because ball of valve will bear torque, usually SSiC, Si₃N₄ and ZrO₂ will be used for ball and seat/lining will be made of 99%Al₂O₃ and SSiC.



High Temp. & Thermal Shock Resistance

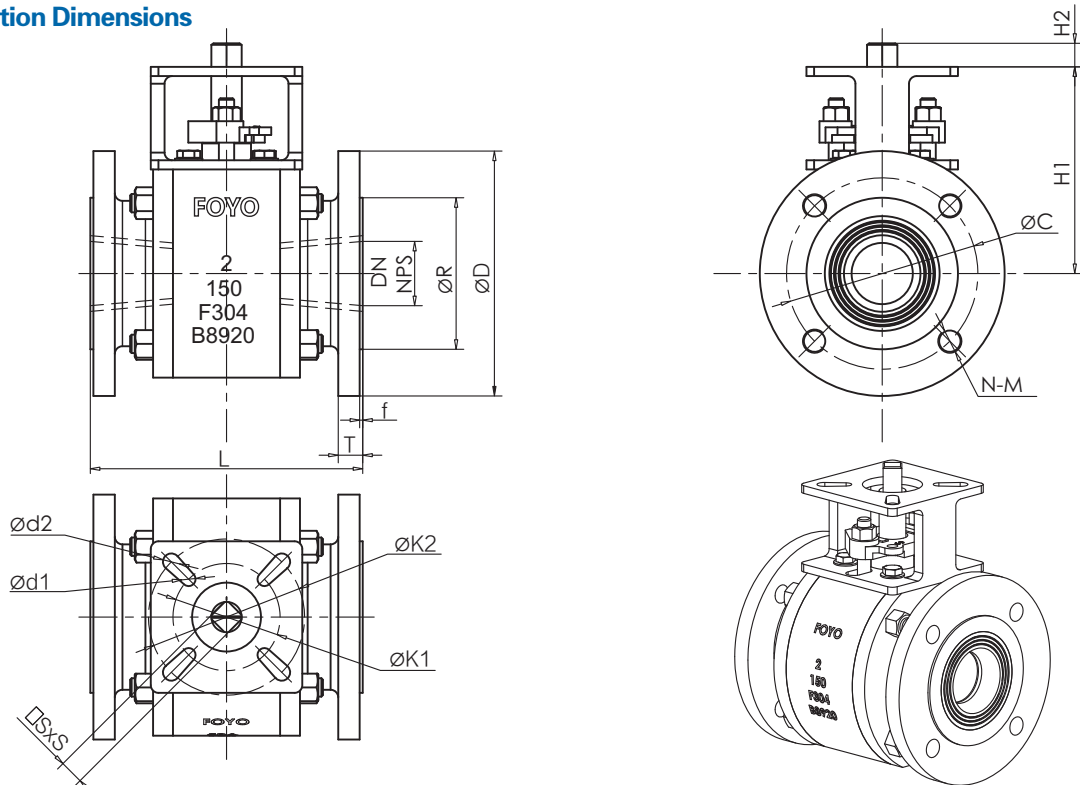
High pure alumina and stabilized zirconia components could keep their shape, structure as well as other physical/chemical characteristics unchanged when applying temperature over 1000 °C. So structure ceramics are also widely used for parts which need to work under high temperature. Different ceramics have different thermal shock resistance. The shape of ceramics will also affect thermal shock resistance of ceramics. In general, ceramics with simple shape like ceramic pipe and ceramic plate has better thermal shock resistance comparing with ceramics with complicated structure. Si₃N₄ has better high-temp.&thermal shock resistance, so it is widely used for higher temperature and thermal shock working conditions.



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Installation Dimensions



SIZE		(EN/DIN 1092-1, PN16, RF)							(ASME B16.5 CL 150, RF)						
		Installation Dimension							Installation Dimension						
A	NPS	L	ΦD	ΦC	N-M	ΦR	T	f	L	ΦD	ΦC	N-M	ΦR	T	f
15	1/2"	108	95	65	4-M12	45	16	2	108	90	60.3	4-M12	34.9	11.6	2
20	3/4"	117	105	75	4-M12	58	18	2	117	100	69.9	4-M12	42.9	13.2	2
25	1"	127	115	85	4-M12	68	18	2	127	110	79.4	4-M12	50.8	14.7	2
32	1 1/4"	140	140	100	4-M16	78	18	2	140	115	88.9	4-M12	63.5	16.3	2
40	1 1/2"	165	150	110	4-M16	88	18	3	165	125	98.4	4-M12	73.0	17.9	2
50	2"	178	165	125	4-M16	102	18	3	178	150	120.7	4-M16	92.1	19.5	2
65	2 1/2"	190	185	145	8-M16	122	20	3	190	180	139.7	4-M16	104.8	22.7	2
80	3"	203	200	160	8-M16	138	22	3	203	190	152.4	4-M16	127.0	24.3	2
100	4"	229	220	180	8-M16	158	24	3	229	230	190.5	8-M16	157.2	24.3	2
125	5"	356	250	210	8-M16	188	24	3	356	255	215.9	8-M20	185.7	24.3	2
150	6"	394	285	240	8-M20	212	26	3	394	280	241.3	8-M20	215.9	25.9	2
200	8"	457	340	295	12-M20	268	29	3	457	345	298.5	8-M20	269.9	29.0	2
250	10"	533	405	355	12-M24	320	30	3	533	405	362.0	12-M24	323.8	30.6	2
300	12"	610	460	410	12-M24	378	32	3	610	485	431.8	12-M24	381.0	32.2	2

Actuation Mounting Dimension

SIZE	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100	DN125	DN150	DN200	DN250	DN300
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
ISO5211	F05/07	F05/07	F05/07	F05/07	F05/07	F07/10	F07/10	F07/10	F10/12	F10/12	F10/12	F14	F14	F14
ΦK1	50	50	50	50	50	70	70	70	102	102	102	140	140	140
n-Φd1	4-Φ8	4-Φ8	4-Φ8	4-Φ8	4-Φ8	4-Φ10	4-Φ10	4-Φ10	4-Φ12	4-Φ12	4-Φ12	4-Φ18	4-Φ18	4-Φ18
ΦK2	70	70	70	70	70	102	102	102	125	125	125	—	—	—
n-Φd1	4-Φ10	4-Φ10	4-Φ10	4-Φ10	4-Φ10	4-Φ12	4-Φ12	4-Φ12	4-Φ14	4-Φ14	4-Φ14	—	—	—
45° □SxS	9X9	9X9	9X9	11X11	11X11	14X14	19X19	19X19	22X22	27X27	27X27	36X36	36X36	36X36
H1	89.5	94	94	103	108	135	146	160	196	213	235	270	330	350
H2	12	12	12	14	15	15	18	20	27	27	27	40	40	50
Torque N.M	19	25	25	30	50	70	110	160	250	300	400	750	1200	1200

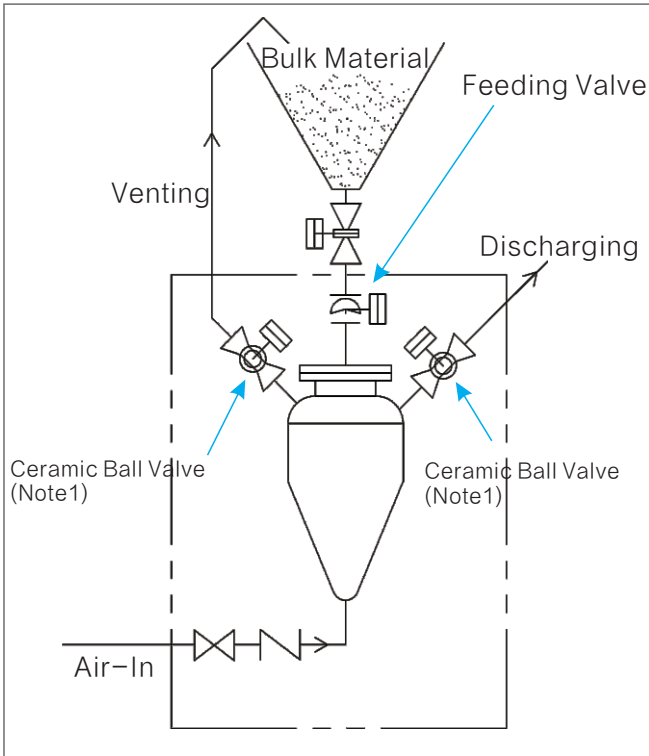
Note: The data above is Foyo' s Standard dimension, customized dimension is available on request.

Pneumatic Conveying System

As the most popular transportation method of powder material all over the world, comparing with other conveying method, this method is more efficient and cleaner. However, when powder materials flow very fast, valve and pipe will be abraded by powder material, which will cause leakage finally. Frequently replacement and maintenance will hugely reduce efficiency of powder pneumatic conveying system.

After applying structure ceramics with high hardness and good mechanical properties to pipes and valves, abrasion problem of valves have been essentially improved. Flow channel of FOYO FCBV ceramic ball valves have been lined with ceramics and ball are made of ceramics, which ensure wear and abrasion are void significantly. Ceramic ball valves have been proved to have great performance in fly ash handling system of power plant, silicone conveying system of polysilicon field and coal injection system of mill steel, etc. Generally, service life of FOYO FCBV ceramic ball valves used in powder pneumatic conveying is about 3 times longer than metal seated valves, even longer.

Diagram of Typical Pneumatic Conveying System



Note1 : Pneumatic Ceramic Double Disc Valve is optional
This is a typical pneumatic conveying unit, and other similar systems are also applicable.

Foyo fully lined ceramic ball valves are widely used in all kinds of powder and solid materials, including :

- >Powder >Resins
- >Pellets >Flakes
- >Fiber >Ash



Main Industries Served:

- >Silicone Powder
- >Dry Coal Ash
- >Cement
- >Magnesium Powder
- >Metallurgical Dust
- >Kaolin
- >Alumina Powder
- >Lime Stone Powder
- >Pulverized Coal Injection
- >Quartz Sand
- >Petroleum Solid Catalyst



Flue Gas Desulfurization, FGD

FGD takes use of lime stone slurry to remove Sox, Nox from flu gases and produces gypsum slurry as a by-product. The biggest technological challenges of FGD systems are the high corrosion and abrasion of lime stone slurry that cause leakage of pipes and valves. Frequently replacement of valves and maintenance will reduce efficiency and increase cost.

FOYO FCBV ceramic ball valve is fully lined with ceramics, so that medium will not be in touch with metal body directly to avoid corrosion/abrasion of body. By using FOYO FCBV ceramic ball valve, stability and service life of valves/pipes can be improved significantly, so efficiency of FGD system could be increased while cost of FGD system could be reduced.

FOYO offers O port and V port as options. V port ceramic ball valves have better equal percentage flow regulation, which could be used as control valves.

