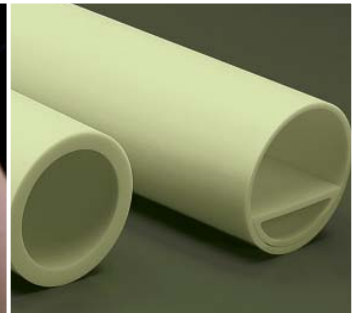


**COORSTEK**  
*Amazing Solutions.®*



**EXTRUDED & CAST CERAMIC PRODUCTS**

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CoorsTek is a leading designer and manufacturer of components, integrated assemblies for the semiconductor capital equipment market and other high technology applications. Serving a wide variety of industries in the global economy, CoorsTek uses technical ceramics, precision-machined metals, high-performance plastics and ultra-pure fused quartz to provide Amazing Solutions to our customers. These solutions enable our customers' products to overcome technological barriers and improve performance, especially in demanding or severe service environments.

CoorsTek has a highly qualified staff to assist with material selection and product design. For assistance with extruded & cast ceramic products, please call:

+1.303.277.4052 tel

+1.303.277.4990 fax

### TERMS OF SALE

- In stock items will typically ship in 3 to 5 working days.
- Expedited shipment available for a nominal fee.
- Terms: Net 30 days (with approved credit). Master Card, Visa, and American Express accepted.
- Minimum line item charge is applicable.
- CoorTek standard terms and conditions apply.
- Verbal orders are placed at the risk of the purchaser.
- CoorsTek reserves the right to add or discontinue items at any time without notice.

### ORDERING INFORMATION

#### Standard Cast Products:

Please specify the following when ordering:

- Quantity
- Outside diameter, inside diameter, and length
- End configuration
  - Closed one end (COE)
  - Open both ends (OBE)
  - Flat closed one end (FCOE)
  - Single reduced end (SRE)
- Material designation

Quantity Discounts,  
Cast Products (units = %):

- 1-5 = 0
- 6-24 = 5
- 25-99 = 10
- >100 quoted on request

#### Standard Extruded Products:

Please specify the following when ordering:

- Quantity (pieces or feet)
- Outside diameter, inside diameter, and length
- Extrusion configuration
  - Round single bore (RSB)
  - Round double bore (RDB)
  - Round 4 bore (R4B)
  - Oval double bore (ODB)
- Material Designation

Quantity Discounts,  
Extruded Products (footage = %):

- 1-99 = 0
- 100-499 = 4
- 500-999 = 8
- >1000 quoted on request
- Minimum order charge is applicable

#### Custom Cast or Extruded Products:

Please specify the following when ordering:

- Quantity
- Dimensional specifications
- Material designation
- Application environment
  - Physical
  - Mechanical
  - Thermal
  - Electrical
  - Chemical

### COORSTEK MATERIAL DESIGNATION

**Mullite:**  $3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$

**AD-998:** 99.8% Dense Alumina ( $\text{Al}_2\text{O}_3$ )

**AD-995:** 99.5% Dense Alumina ( $\text{Al}_2\text{O}_3$ )

**AD-94:** 94.0% Dense Alumina ( $\text{Al}_2\text{O}_3$ )

**TTZ:** Magnesia partially stabilized Zirconia ( $\text{ZrO}_2$ )

**YTZP:** Yttria partially stabilized Zirconia ( $\text{ZrO}_2$ )

**ZDY:** Yttria fully stabilized Zirconia ( $\text{ZrO}_2$ )

### TO ORDER:

#### Extruded & Cast Products Group

+1.303.277.4052 tel  
+1.303.277.4990 fax

tubes@coorstek.com  
www.coorstek.com

# ALUMINA EXTRUDED TUBING

## AD-998 Round Single Bore Tubing



(RSB)

OD Inch	ID Inch	OD mm	ID mm	Part#
0.050	x 0.020	1.27	x 0.51	65650
0.063	x 0.031	1.60	x 0.79	65651
0.094	x 0.040	2.39	x 1.02	65652
0.094	x 0.063	2.39	x 1.60	65682
0.100	x 0.050	2.54	x 1.27	65653
0.125	x 0.063	3.18	x 1.60	65654
0.156	x 0.094	3.96	x 2.39	65655
0.188	x 0.094	4.78	x 2.39	65665
0.188	x 0.125	4.78	x 3.18	65656
0.219	x 0.156	5.56	x 3.96	65657
0.250	x 0.125	6.35	x 3.18	65663

OD Inch	ID Inch	OD mm	ID mm	Part#
0.250	x 0.156	6.35	x 3.96	65666
0.250	x 0.188	6.35	x 4.78	65658
0.313	x 0.188	7.95	x 4.78	65667
0.313	x 0.219	7.95	x 5.56	65659
0.375	x 0.250	9.53	x 6.35	65660
0.438	x 0.313	11.13	x 7.95	65661
0.500	x 0.250	12.70	x 6.35	65669
0.500	x 0.375	12.70	x 9.53	65664
0.590	x 0.394	14.98	x 10.00	65810
0.590	x 0.433	14.98	x 11.00	65811

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

OD Inch	ID Inch	OD mm	ID mm	Part#
0.625	x 0.500	15.88	x 12.70	65677
0.688	x 0.500	17.48	x 12.70	65679
0.750	x 0.500	19.05	x 12.70	65662

OD Inch	ID Inch	OD mm	ID mm	Part#
0.750	x 0.563	19.05	x 14.30	65680
0.875	x 0.625	22.23	x 15.88	65668
1.000	x 0.750	25.40	x 19.05	65825

Diameter tolerance  $\pm 5\%$ . Straightness:  $\leq 0.003"/1.000"$  cumulative

## AD-998 Round Double Bore Tubing



(RDB)

OD Inch	ID Inch	OD mm	ID mm	Part#
0.063	x 0.016	1.60	x 0.41	65670
0.094	x 0.025	2.39	x 0.64	65671
0.109	x 0.031	2.77	x 0.79	65672
0.125	x 0.031	3.18	x 0.79	65678
0.125	x 0.040	3.18	x 1.02	65673
0.156	x 0.052	3.96	x 1.32	65674

OD Inch	ID Inch	OD mm	ID mm	Part#
0.188	x 0.040	4.78	x 1.02	65835
0.188	x 0.047	4.78	x 1.19	65836
0.188	x 0.063	4.78	x 1.60	65675
0.200	x 0.052	5.08	x 1.32	65676
0.240	x 0.078	6.10	x 1.98	65693
0.250	x 0.063	6.35	x 1.60	65690

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

## AD-998 Round Four Bore Tubing



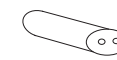
(R4B)

OD Inch	ID Inch	OD mm	ID mm	Part#
0.063	x 0.016	1.60	x 0.41	65684
0.085	x 0.024	2.13	x 0.60	65692
0.094	x 0.020	2.39	x 0.51	65683
0.109	x 0.020	2.77	x 0.51	65687

OD Inch	ID Inch	OD mm	ID mm	Part#
0.188	x 0.031	4.78	x 0.79	65685
0.188	x 0.047	4.75	x 1.19	65698
0.219	x 0.050	5.56	x 1.27	65686
0.258	x 0.078	6.55	x 1.98	65689

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

## AD-998 Oval Double Bore Tubing



(ODB)

OD Inch (major)	OD Inch (minor)	ID Inch	OD mm (major)	OD mm (minor)	ID mm	Part#
0.077	0.051	x 0.014	1.96	1.30	x 0.36	65695
0.120	0.070	x 0.031	3.05	1.78	x 0.79	65697
0.163	0.112	x 0.040	4.14	2.84	x 1.02	65696

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

## AD-998 As Fired Rods



OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.011	0.28	65987	0.096	2.44	65951
0.020	0.51	65983	0.125	3.18	65968
0.022	0.56	65988	0.137	3.48	65953
0.024	0.61	65981	0.188	4.78	65969
0.029	0.74	65980	0.197	5.00	65954
0.030	0.76	65985	0.212	5.38	65991
0.035	0.89	65974	0.250	6.35	65970
0.040	1.02	65982	0.264	6.71	65955
0.041	1.04	65984	0.313	7.95	65971
0.043	1.09	65993	0.375	9.53	65972
0.048	1.22	65975	0.388	9.86	65952
0.056	1.42	65976	0.400	10.16	65956
0.063	1.60	65967	0.440	11.18	65973
0.072	1.83	65950	0.500	12.70	65958

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

0.518	13.16	65977	0.750	19.05	65960
0.625	15.88	65959	0.775	19.69	65979
0.640	16.26	65978			

Diameter tolerance  $\pm 5\%$ . Straightness:  $\leq 0.003"/1.000"$  cumulative

*1.100	27.94	30315	*1.350	34.29	30316
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Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.010"/1.000"$  cumulative

\* Isostatically pressed

## AD-998 Ground Rods

OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.060	1.52	65961	0.250	6.35	65965
0.080	2.03	65962	0.375	9.53	65966
0.125	3.18	65963	0.500	12.70	65957
0.188	4.78	65964			

Diameter tolerance  $\pm 0.001"$  or  $\pm 0.025$  mm. Straightness:  $\leq 0.001"/1.000"$  cumulative

## AD-998 Square/Rectangular Rods



Width/Thickness Inch	Width/Thickness mm	Part#	Width/Thickness Inch	Width/Thickness mm	Part#
0.125/0.125	3.18/3.18	65995	0.250/0.250	6.35/6.35	65996
0.156/0.156	4.0/4.0	65997	0.500/0.250	12.70/6.35	65999

Diameter tolerance  $\pm 3\%$ . Straightness:  $\leq 0.003"/1.000"$  cumulative

Maximum twist  $2^\circ$  per foot.

# ALUMINA AND ZIRCONIA RODS



## AD-94 As Fired Rods

OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.035	0.89	81738	0.188	4.78	81742
0.048	1.22	81700	0.197	5.00	81716
0.056	1.42	81701	0.250	6.35	81743
0.063	1.60	81740	0.264	6.71	81718
0.072	1.83	81706	0.313	7.95	81744
0.110	2.79	81710	0.375	9.53	81745
0.125	3.18	81741	0.388	9.86	81702
0.137	3.48	81714	0.440	11.18	81746
			0.500	12.70	81737
Diameter tolerance $\pm 3\%$ or $\pm 0.003"$ (0.076 mm), whichever is greater. Straightness: $\leq 0.003"/1.000"$ cumulative					
0.625	15.88	81747	1.000	25.40	81739
0.750	19.05	81748			
Diameter tolerance $\pm 5\%$ . Straightness: $\leq 0.003"/1.000"$ cumulative					

## AD-94 Ground Rods

OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.060	1.52	81705	0.250	6.35	81717
0.125	3.18	81713	0.375	9.53	81719
Diameter tolerance $\pm 0.001"$ or $\pm 0.025$ mm. Straightness: $\leq 0.001"/1.000"$ cumulative					

## TTZ As Fired Rods

OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.063	1.60	66837	0.375	9.53	66834
0.125	3.18	66838	0.390	9.91	66840
0.150	3.81	66831	0.438	11.13	66835
0.188	4.78	66839	0.500	12.70	66836
0.250	6.35	66832	*1.100	27.94	30313
0.313	7.95	66833	*1.350	34.29	30314
Diameter tolerance $\pm 3\%$ or $\pm 0.003"$ (0.076 mm), whichever is greater. Straightness: $\leq 0.003"/1.000"$ cumulative					
* Isostatically pressed					

## YTZP As Fired Rods

OD Inch	OD mm	Part#	OD Inch	OD mm	Part#
0.072	1.83	66900	0.197	5.00	66902
0.137	3.48	66901	0.264	6.71	66903
Diameter tolerance $\pm 3\%$ or $\pm 0.003"$ (0.076 mm), whichever is greater. Straightness: $\leq 0.003"/1.000"$ cumulative					

**AD-998 Cast Tubing**

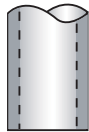
OD Inch	ID Inch	OD mm	ID mm	Part#
0.250	x 0.156	6.35	x 3.96	66440
0.313	x 0.188	7.95	x 4.78	66441
0.375	x 0.250	9.53	x 6.35	66442
0.394	x 0.236	10.00	x 6.00	66420
0.394	x 0.276	10.00	x 7.00	66421
0.438	x 0.313	11.13	x 7.95	66443
0.500	x 0.250	12.70	x 6.35	66444
0.500	x 0.375	12.70	x 9.53	66445
0.688	x 0.438	17.48	x 11.13	66448
0.688	x 0.500	17.48	x 12.70	66449
0.750	x 0.500	19.05	x 12.70	66450
0.750	x 0.563	19.05	x 14.30	66451
0.875	x 0.625	22.23	x 15.88	66453
0.938	x 0.688	23.83	x 17.48	66454
*1.000	x 0.750	25.40	x 19.05	66455
1.125	x 0.875	28.58	x 22.23	66456
1.250	x 1.000	31.75	x 25.40	66457
1.375	x 1.125	34.93	x 28.58	66458
1.500	x 1.250	38.10	x 31.75	66459
*1.625	x 1.375	41.28	x 34.93	66460
*1.750	x 1.500	44.45	x 38.10	66461
*1.875	x 1.625	47.63	x 41.28	66462
2.000	x 1.750	50.80	x 44.45	66463
*2.125	x 1.875	53.98	x 47.63	66464

OD Inch	ID Inch	OD mm	ID mm	Part#
2.250	x 2.000	57.15	x 50.80	66465
*2.375	x 2.125	60.33	x 53.98	66466
2.500	x 2.250	63.50	x 57.15	66467
2.750	x 2.375	69.85	x 60.33	66468
2.750	x 2.500	69.85	x 63.50	66469
*3.000	x 2.750	76.20	x 69.85	66471
*3.250	x 2.875	82.55	x 73.03	66473
*3.500	x 3.125	88.90	x 79.38	66476
*3.500	x 3.250	88.90	x 82.55	66477
*3.750	x 3.375	95.25	x 85.73	66479
4.000	x 3.625	101.60	x 92.08	66481
4.250	x 3.875	107.95	x 98.43	66482
4.500	x 4.125	114.30	x 104.78	66483
4.750	x 4.375	120.65	x 111.13	66484
5.000	x 4.625	127.00	x 117.48	66485
5.250	x 4.875	133.35	x 123.86	66486
5.500	x 5.125	139.70	x 130.18	66489
6.000	x 5.625	152.40	x 142.88	66491
6.500	x 6.125	165.10	x 155.58	66492
7.000	x 6.625	177.80	x 168.28	66493
7.500	x 7.125	190.50	x 180.98	66494
†7.875	x 7.500	200.03	x 190.50	66495
†8.250	x 7.875	209.55	x 200.03	66496

Diameter tolerance  $\pm 5\%$  or  $\pm 0.030"$  (0.76 mm), whichever is greater. Straightness:  $\leq 0.006"/1.000"$  cumulative

\* Available in single reduced end (SRE).

† Available on a special order basis.



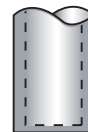
Open Both Ends (OBE)



Closed One End (COE)



Single Reduced End (SRE)



Flat Closed One End (FCOE)

ALUMINA DEE TUBING

**AD-998 Dee Tubing**

to fit tubes with the following ID sizes



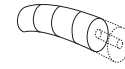
ID Inch	ID mm	Part#
1.500	38.10	65703
1.750	44.45	65711
2.000	50.80	65704
2.250	57.15	65705

ID Inch	ID mm	Part#
2.500	63.50	65706
2.750	69.85	65707
4.000	101.60	65708

Diameter tolerance  $\pm 5\%$  or  $\pm 0.030"$  (0.76 mm), whichever is greater. Straightness:  $\leq 0.006"/1.000"$  cumulative  
Tooling available in other sizes – please inquire.

## FISH SPINE BEADS

### AD-995 Fish Spine Beads

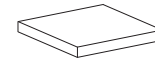


OD Inch	ID Inch	Length Inch	OD mm	ID mm	Length mm	Part#
0.090	0.040	0.125	2.29	1.02	3.18	67000
0.170	0.065	0.188	4.32	1.52	4.78	67001
0.330	0.133	0.313	8.38	3.38	7.95	67002

Diameter tolerance  $\pm 2\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Length tolerance  $\pm 0.010"$

## RECTANGULAR PLATES

### TTZ and AD-995 Rectangular Plates



Width Inch	Length Inch	Thickness Inch	Width mm	Length mm	Thickness mm	Material	Part#
4.00 x	6.00 x	0.500	101.60 x	152.40 x	12.70	TTZ	46250-2
4.00 x	6.00 x	0.500	101.60 x	152.40 x	12.70	AD-995	46264-2

Tolerance  $\pm 2\%$ . Straightness:  $\leq 0.006"/1.000"$  cumulative

## MULLITE EXTRUDED TUBING

### Mullite Round Single Bore Tubing



(RSB)

OD Inch	ID Inch	OD mm	ID mm	Part#	OD Inch	ID Inch	OD mm	ID mm	Part#
0.078 x	0.047	1.98 x	1.19	66618	0.313 x	0.250	7.95 x	6.35	66633
0.125 x	0.063	3.18 x	1.60	66620	0.375 x	0.125	9.53 x	3.18	66634
0.125 x	0.094	3.18 x	2.39	66621	0.375 x	0.188	9.53 x	4.78	66635
0.156 x	0.094	3.96 x	2.39	66623	0.375 x	0.250	9.53 x	6.35	66636
0.188 x	0.125	4.78 x	3.18	66626	0.438 x	0.313	11.13 x	7.95	66637
0.219 x	0.125	5.56 x	3.18	66627	0.500 x	0.125	12.70 x	3.18	66638
0.250 x	0.063	6.35 x	1.60	66628	0.500 x	0.250	12.70 x	6.35	66640
0.250 x	0.125	6.35 x	3.18	66630	0.500 x	0.313	12.70 x	7.95	66641
0.250 x	0.188	6.35 x	4.78	66631	0.500 x	0.375	12.70 x	9.53	66642
0.313 x	0.188	7.95 x	4.78	66632	0.500 x	0.406	12.70 x	10.31	66643

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003"$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003"/1.000"$  cumulative

0.625 x	0.500	15.88 x	12.70	66603
0.688 x	0.500	17.48 x	12.70	66604
0.750 x	0.500	19.05 x	12.70	66601

Diameter tolerance  $\pm 5\%$ . Straightness:  $\leq 0.003"/1.000"$  cumulative

0.750 x	0.563	19.05 x	14.30	66644
0.875 x	0.625	22.23 x	15.88	66602

**Mullite Round Double Bore Tubing**



(RDB)

OD Inch	ID Inch	OD mm	ID mm	Part#	OD Inch	ID Inch	OD mm	ID mm	Part#
0.063	x 0.016	1.60	x 0.41	66645	0.250	x 0.040	6.35	x 1.02	66655
0.125	x 0.040	3.18	x 1.02	66648	0.250	x 0.063	6.35	x 1.60	66656
0.188	x 0.063	4.78	x 1.60	66653	0.500	x 0.125	12.70	x 3.18	66658

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003''$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003''/1.000''$  cumulative

**Mullite Round Four Bore Tubing**



(R4B)

OD Inch	ID Inch	OD mm	ID mm	Part#	OD Inch	ID Inch	OD mm	ID mm	Part#
0.188	x 0.047	4.78	x 1.19	66667	0.250	x 0.063	6.35	x 1.60	66669

Diameter tolerance  $\pm 3\%$  or  $\pm 0.003''$  (0.076 mm), whichever is greater. Straightness:  $\leq 0.003''/1.000''$  cumulative  
Tooling available in other sizes – please inquire.

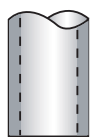
MULLITE CAST TUBING

**Mullite Cast Tubing**

OD Inch	ID Inch	OD mm	ID mm	Part#	OD Inch	ID Inch	OD mm	ID mm	Part#
0.250	x 0.156	6.35	x 3.96	66300	* 2.750	x 2.500	69.85	x 63.50	66329
0.313	x 0.188	7.95	x 4.78	66301	* 3.000	x 2.500	76.20	x 63.50	66330
0.375	x 0.250	9.53	x 6.35	66302	* 3.000	x 2.750	76.20	x 69.85	66331
0.438	x 0.313	11.13	x 7.95	66303	3.250	x 2.875	82.55	x 73.03	66333
0.500	x 0.375	12.70	x 9.53	66305	3.250	x 3.000	82.55	x 76.20	66334
0.563	x 0.438	14.30	x 11.13	66306	* 3.500	x 3.125	88.90	x 79.38	66336
0.688	x 0.438	17.48	x 11.13	66308	* 3.500	x 3.250	88.90	x 82.55	66337
0.750	x 0.500	19.05	x 12.70	66310	3.750	x 3.375	95.25	x 85.75	66339
* 1.000	x 0.750	25.40	x 19.05	66315	4.000	x 3.500	101.60	x 88.90	66340
* 1.125	x 0.875	28.58	x 22.23	66316	4.000	x 3.625	101.60	x 92.08	66341
* 1.250	x 1.000	31.75	x 25.40	66317	4.250	x 3.875	107.95	x 98.43	66342
* 1.375	x 1.125	34.93	x 28.58	66318	4.500	x 4.125	114.30	x 104.78	66343
* 1.500	x 1.250	38.10	x 31.75	66319	4.750	x 4.375	120.65	x 111.13	66344
* 1.625	x 1.375	41.28	x 34.93	66320	5.000	x 4.625	127.00	x 117.48	66345
* 1.750	x 1.500	44.45	x 38.10	66321	5.375	x 5.000	136.56	x 127.00	66347
1.875	x 1.625	47.63	x 41.28	66322	5.500	x 5.125	139.70	x 130.18	66349
* 2.000	x 1.750	50.80	x 44.45	66323	5.750	x 5.375	146.05	x 136.53	66350
2.125	x 1.875	53.98	x 47.63	66324	6.000	x 5.625	152.40	x 142.88	66351
* 2.250	x 2.000	57.15	x 50.80	66325	6.500	x 6.125	165.10	x 155.58	66352
2.375	x 2.125	60.33	x 53.98	66326	7.500	x 7.125	190.50	x 180.98	66354
* 2.500	x 2.250	63.50	x 57.15	66327	7.875	x 7.500	200.03	x 190.50	66355
* 2.750	x 2.375	69.85	x 60.33	66328					

Diameter tolerance  $\pm 5\%$  or  $\pm 0.030''$  (0.76 mm), whichever is greater. Straightness:  $\leq 0.006''/1.000''$  cumulative

\* Available in single reduced end (SRE).



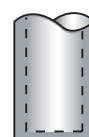
Open Both Ends (OBE)



Closed One End (COE)



Single Reduced End (SRE)



Flat Closed One End (FCOE)

## YTTRIA FULLY STABILIZED ZIRCONIA (ZDY)

CoorsTek ZDY zirconia system is specifically designed to work in applications where oxygen ionic conductivity or extreme temperature resistance is required.

CoorsTek Oxygen Sensors and Carbon Probe electrolytes will be your choice when your application demands:

- High output (> 98% of theoretical by the Nernst equation)
- Low offset (< 0.5m V at 750° C)
- Low internal resistance (< 25 ohms at 750° C)
- Quick response times

CoorsTek can provide electrolyte cells from bare zirconia to platinum metallized--with or without platinum lead attachment.

Other typical applications include:

- High Temperature Thermocouple protection tubing
- RF Induction Elements

Whatever your application, CoorsTek will work with you to supply a ZDY material that will fit your needs.

## PLASTIC

CoorsTek also offers the following PTFE options. For more information contact the CoorsTek Engineering Plastics Group toll free at 800-421-2054.

### Molded:

- Materials
  - Virgin PTFE
  - PTFE filled with glass
  - Bronze
  - Graphite
  - Carbon, etc.
- Rod size
  - $\frac{5}{8}$ " to 10  $\frac{1}{2}$ " (15.9 mm to 266.7 mm) dia
- Tube size
  - $\frac{1}{4}$ " x 1  $\frac{1}{16}$ " to 2  $\frac{3}{4}$ " x 3  $\frac{1}{4}$ " (6.4 mm x 27 mm to 69.9 mm x 82.6 mm) dia
- Max length
  - 6" (152.4 mm) depending on diameter

### Extruded

- Materials
  - Virgin PTFE
  - PTFE filled with glass
  - Bronze
  - Graphite
  - Carbon, etc.
- Rod size
  - $\frac{3}{16}$ " to 2  $\frac{3}{8}$ " (4.8 mm to 60.3 mm)
- Tube size
  - $\frac{1}{8}$ " x  $\frac{3}{8}$ " to 2  $\frac{3}{4}$ " x 3  $\frac{1}{4}$ " (3.2 mm x 9.5mm to 69.9 mm x 82.66 mm)
- Max length
  - 144" (3657.6 mm) depending on diameter

**Engineering Plastics Group**  
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www.coorstek.com

## CUSTOM PRODUCTS

Advanced technical ceramics provide a broad variety of unique engineering properties to improve or extend the performance of your product.

When your application demands:

- Extreme temperature stability
- Excellent dielectric properties
- Hard and wear resistant surfaces
- Low coefficient of thermal expansion
- Corrosion resistance

CoorsTek can assist you with:

- A broad range of material selections
- Custom shapes and sizes
- Machining to precision tolerances
- Polished surfaces
- Intricate shape capability

Contact a CoorsTek application engineer at the earliest stage in your design process to aid you in material selection and design considerations to achieve the optimum balance between performance and cost objectives.

## MATERIAL COMPARISON CHART

			Mullite	Alumina			Zirconia		
PROPERTIES	UNITS	TEST	3AL <sub>2</sub> O <sub>3</sub> ·2SiO <sub>2</sub>	AD-94	AD-998	AD-995	TTZ	YTZP	ZDY
<b>Physical Properties</b>									
Density	grams/cc	ASTM C20	2.80	3.70	3.92	3.90	5.72	6.02	5.60
Color			Tan	White	Ivory	Ivory	Ivory	Ivory	Ivory
Permeability			Gas-Tight	Gas-Tight	Gas-Tight	Gas-Tight	Gas-Tight	Gas-Tight	Ionic
<b>Mechanical Properties</b>									
Elastic Modulus Typical 20° C	GPa(psi • 10 <sup>9</sup> )	ASTM C848	150 (22)	303 (44)	370 (54)	370 (54)	200 (29)	210 (30)	173 (25)
Flexural Strength (MOR) Typical 20° C	MPa (kpsi)	C1161-02	170 (25)	352 (51)	375 (54)	379 (55)	620 (90)	900 (130)	207 (30)
Typical 1000° C			151 (22)	138 (20)	210 (30)	–	–	–	–
Compressive Strength Typical 20° C	MPa (kpsi)	ASTM C773	550 (80)	2103 (305)	2500 (363)	2600 (377)	1750 (254)	2500 (363)	– –
Fracture Toughness Range	MPa • m <sup>1/2</sup>	NOTCHED BEAM	2	4 - 5	4 - 5	4 - 5	11	13	3
Hardness	NEWTONS GPa(Kg/mm <sup>2</sup> )	ROCKWELL 45N KNOOP 1000g	70 7.4 (750)	78 11.5 (1175)	83 14.1 (1440)	83 14.1 (1440)	77 11.8 (1200)	81 12.7 (1300)	75 –
<b>Thermal Properties</b>									
Thermal Conductivity 20° C	W/m <sup>2</sup> K	ASTM C408	3.5	22.4	30.0	30.0	2.2	2.2	2.2
Coefficient of Thermal Expansion 25 to 1000° C	10 <sup>-6</sup> /°C (10 <sup>-6</sup> /°F)	ASTM C372	5.3 (2.9)	8.2 (4.6)	8.2 (4.6)	8.2 (4.6)	10.1 (5.6)	10.3 (5.7)	10.5 (5.8)
Specific Heat at 100° C	j/kg <sup>2</sup> K (cal/g/°C)	ASTM E1269	950 (0.23)	880 (0.21)	880 (0.21)	880 (0.21)	400 (0.14)	400 (0.10)	– –
Thermal Shock (Note 1)	D°C(D°F)	DTc	300 (570)	250 (480)	200 (392)	200 (392)	350 (660)	350 (660)	150 (300)
<b>Electrical Properties</b>									
Dielectric Strength 6.25 mm Thickness	AC-kv/mm (AC-volts/mil)	ASTM D116	9.8 (248)	8.3 (210)	8.7 (220)	8.7 (220)	9.4 (240)	9.0 (228)	– –
Dielectric Loss	25°C@1MHz 25°C@5GHz	ASTM D2520	0.002 –	0.0004 0.0095	< 0.0001 < 0.0001	< 0.0001 < 0.0001	0.001 –	0.001 –	– –
Volume Resistivity 25° C 500° C 1000° C	ohm-cm	ASTM D1829	> 10 <sup>14</sup> 5 x 10 <sup>12</sup> 3 x 10 <sup>9</sup>	> 10 <sup>14</sup> 4 x 10 <sup>9</sup> 5 x 10 <sup>5</sup>	> 10 <sup>14</sup> 2 x 10 <sup>10</sup> 5 x 10 <sup>7</sup>	> 10 <sup>14</sup> 2 x 10 <sup>10</sup> 2 x 10 <sup>6</sup>	> 10 <sup>13</sup> 2 x 10 <sup>5</sup> < 10 <sup>3</sup>	> 10 <sup>13</sup> 2 x 10 <sup>4</sup> < 10 <sup>3</sup>	– – –
Dielectric Constant	25° C@1MHz		6.0	9.1	9.8	9.7	28.0	29.0	–
<b>General Characteristics</b>			Good thermal shock resistance NOT recommended for high temp. vacuum application (low cost)	Easily metallized with good electrical properties	Hard, corrosive resistant, capable of withstanding use at high temperature, low dielectric loss at microwave frequencies	Impact resistant, very tough, corrosion resistant	Impact resistant, high strength, polishes easily	Oxygen ionic conductive, extreme temperature resistant	

This chart is intended to illustrate typical properties of advanced ceramic materials available from CoorsTek.

The information set forth herein is offered for comparison only, and is not to be construed as absolute engineering data or constituting a warranty or representation for which we assume legal responsibility.

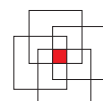
**Note 1** Thermal Shock Resistance – Tests are run by quenching samples into water from various elevated temperatures. The change in temperature where a sharp decrease in flexural strength is observed is listed as ΔTc.



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