



SOLID OXIDE FUEL CELLS (SOFC)

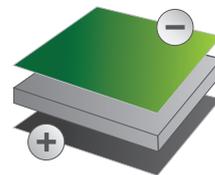
Customized Solutions

Innovation in **Environmental Technology**
and **Power Generation**

SOFC Products

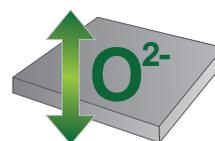
Electrolyte Supported Cells

KERAFOL® offers SOCs with various electrode materials on different electrolyte substrates. Customers can choose between electrolytes with a higher power density or a higher mechanical stability. The electrode materials can be chosen according to their application. KeraCell III electrodes provide not only a high performance for SOFC but also for SOE applications.



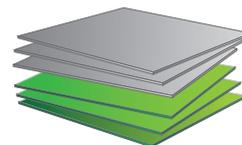
Electrolyte Substrates

We offer zirconia based electrolyte substrates with various dopant elements. Depending on the dopant concentration the substrates feature a higher conductivity for oxygen ions or a higher mechanical stability.



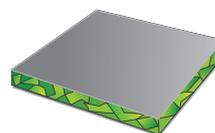
Keralpor 99 Z

Keralpor 99 Z is required for materials reacting with alumina. The zirconia coating of Keralpor 99 Z prevents a reaction between alumina and the part to be sintered. This type of setter is excellently suited to sinter solid oxide cells.



Glass Sealing Tapes

Our glass sealing tapes are best suited for a long-term stable gas-tight assembling of CFY (chromium based alloy) or ferritic steel with zirconia electrolytes.



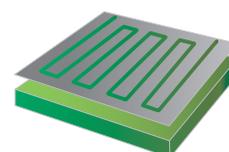
Tape Development (R & D)

KERAFOL® has long experience in the development and production of customized porous and dense ceramic tapes consisting of various polymer / ceramic, ceramic and glass-ceramic materials for a wide range of applications. KERAFOL® offers the complete development and production of tapes based on customized powders.



Thin Zirconia Substrates

Originally developed as a thin electrolyte for solid oxide cells, those substrates are excellently suited for electronics applications as well. Their low thickness, high planarity and great flexibility make them a perfect choice for thin film processes or curved fittings.



Electrolyte Supported Cells



Key features

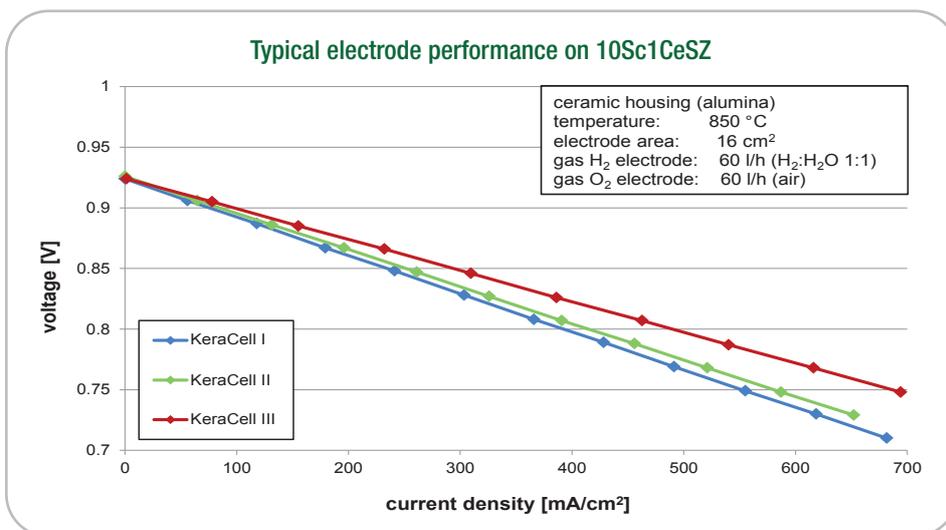
- electrolyte supported cells based on zirconia substrates
- high planarity and mechanical stability
- long term stability, redox stability, thermal cycling stability
- KeraCell III suited for electrolysis

Cell performance – electrode materials (10Sc1CeSZ electrolyte)

Characteristics	Unit	KeraCell I	KeraCell II	KeraCell III
Electrolyte thickness	[μm]	160	160	160
Current density (0.7 V)	[mA/cm^2]	710*	750*	880*
Area specific resistance	[Ωcm^2]	0.32	0.30	0.26

* extrapolated value

Typical electrode performance on 10Sc1CeSZ

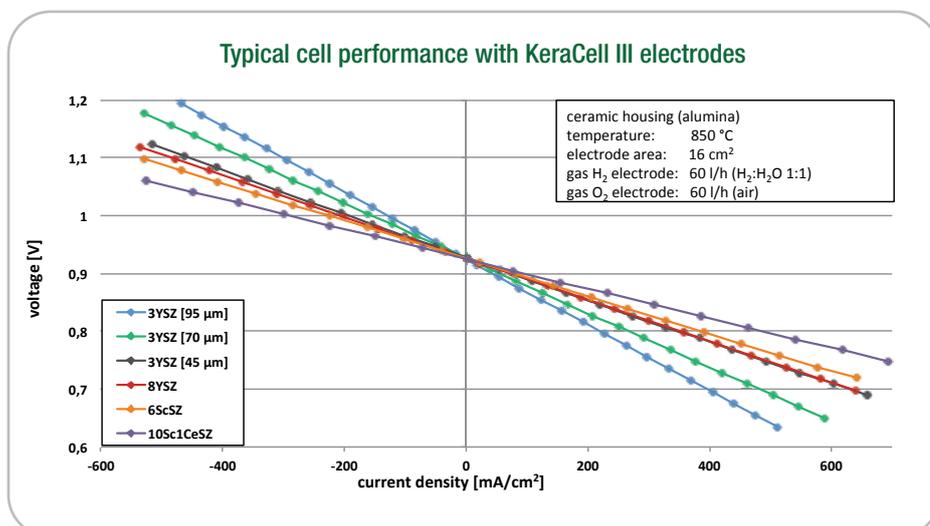


Cell performance – electrolyte materials (KeraCell III)

Characteristics	Unit	3YSZ	3YSZ	3YSZ	8YSZ	6ScSZ	10Sc1CeSZ
Electrolyte thickness	[μm]	95	70	45	160	130	160
Current density (0.7 V)	[mA/cm^2]	390	480	630	630	710*	880*
Voltage at -500 mA/cm ²	[V]	1.21*	1.16	1.12	1.11	1.09	1.05
Area specific resistance	[Ωcm^2]	0.58	0.47	0.36	0.36	0.32	0.26

* extrapolated value

Typical cell performance with KeraCell III electrodes



Electrolyte Substrates



Key features

- thin electrolyte substrates based on zirconia
- partially or fully stabilized with yttria or/and scandia
- high planarity and gas-tight
- available with various thicknesses

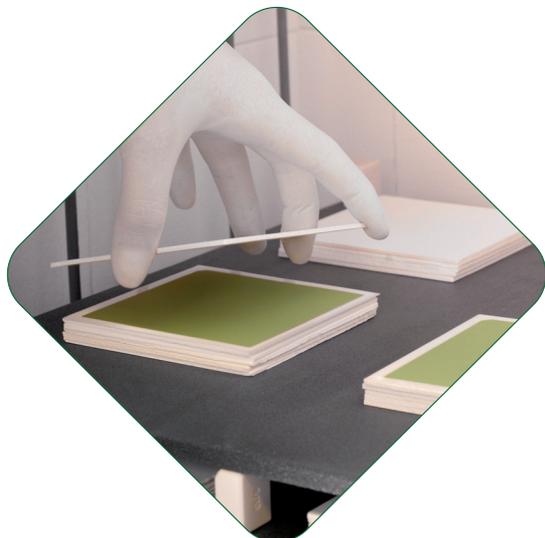
KERAFOL® offers zirconia based electrolyte substrates with different dopant elements. Depending on the dopant concentration, the substrates feature a higher oxygen ion conductivity or a higher mechanical strength.

Characteristics	Unit	3YSZ	3YSZ	8YSZ
Dopant, stabilization	[mol-%]	Yttria, 3	Yttria, 3	Yttria, 8
Thickness	[μm]	95	45	160
Ionic conductivity (at 850 °C)	[S/m]	2.1	2.1	8.0
Mechanical strength (Kerafol double ring test, 8YSZ = 100%)	[%]	330	160	100
Sinter density	[g/cm ³]	> 6.00	> 6.00	> 5.95

Characteristics	Unit	6ScSZ	10Sc1CeSZ	YScSZ
Dopant, stabilization	[mol-%]	Scandia, 6	Scandia, 10 / Ceria, 1	Yttria / Scandia / Ceria
Thickness	[μm]	130	160	150
Ionic conductivity (at 850 °C)	[S/m]	8.2	17.0	7.8
Mechanical strength (Kerafol double ring test, 8YSZ = 100%)	[%]	270	140	140
Sinter density	[g/cm ³]	> 5.85	> 5.70	> 5.90

Keralpor 99 Z

Alumina setter + Zirconia coating



Characteristics	Unit	Value
Colour of alumina support	-	white
Gross density	[g/cm ³]	2.56
Surface roughness R _a	[µm]	< 1
Bending strength	[MPa]	60
Camber	[%]	< 0.3
Porosity	[Vol.-%]	36 - 38
Average pore size	[µm]	1
Standard dimensions	[mm]	100 x 100 / 150 x 150
Thickness	[mm]	2.0
Compounding of support	[%]	99.5 Al ₂ O ₃
Zirconia coating	-	3 mol-% Yttrium stabilized zirconia
Colour of zirconia coating	-	beige
Maximum operating temperature	[°C]	1400

Keralpor 99 Z is required for materials reacting with Al₂O₃ and when a high evenness and purity is desired. The zirconia coating of Keralpor 99 Z prevents a reaction between Al₂O₃ and the part to be sintered. Additionally, due to the porous structure of the setter an adherence of the overlying ware can be avoided.

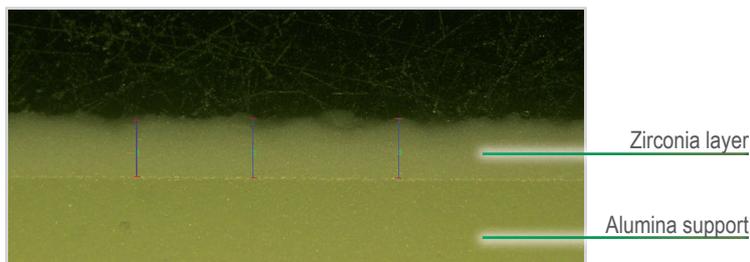
This type of setter is preferably used to sinter solid oxide cells. Please ask for your tailor-made dimensions.

Advantages

- cheap setter for high-quality ceramic and metal injection moulding (MIM) components
- gases can freely diffuse through the setter and coating
- customized dimensions of the setters are possible
- good mechanical strength given the high open porosity
- very good flatness and surface quality

Applications

- sintering setter for solid oxide cells (SOC)
- sintering setter for dental zirconia and jewelry zirconia ceramics
- sintering setter for e.g. Ti-metal injection moulding (MIM) materials



Glass Sealing Tapes



Key features

- alkali free glass sealing tapes for CFY and ferritic interconnectors
- gas-tight
- long-term stability
- formation of stable glass ceramic after partial crystallization
- joining of steel/steel or steel/ceramic

Characteristics	Unit	KeraGlas ST K03
TEC 660°C of crystallized glass	[10 ⁻⁶ /K]	10.0 ± 0.5
TEC range of joining partners	[10 ⁻⁶ /K]	9.5 ...12
Designated SOC operating temperature	[°C]	650...820
Joining temperature*	[°C]	830...850
Durability SOC steels		CFY / CroFer22APU / ZMG232L / ITM / CroFer22H
Durability SOC electrolytes		YSZ / ScSZ
Non-compatibilities		La _{1-x} Sr _x MnO ₃ , La _{1-x} Sr _x Mn _{1-y} Co _y O ₃ / MnCo _{2-x} Fe _x O ₄

* complete firing schedule will be communicated on request

Tape Development (R & D)

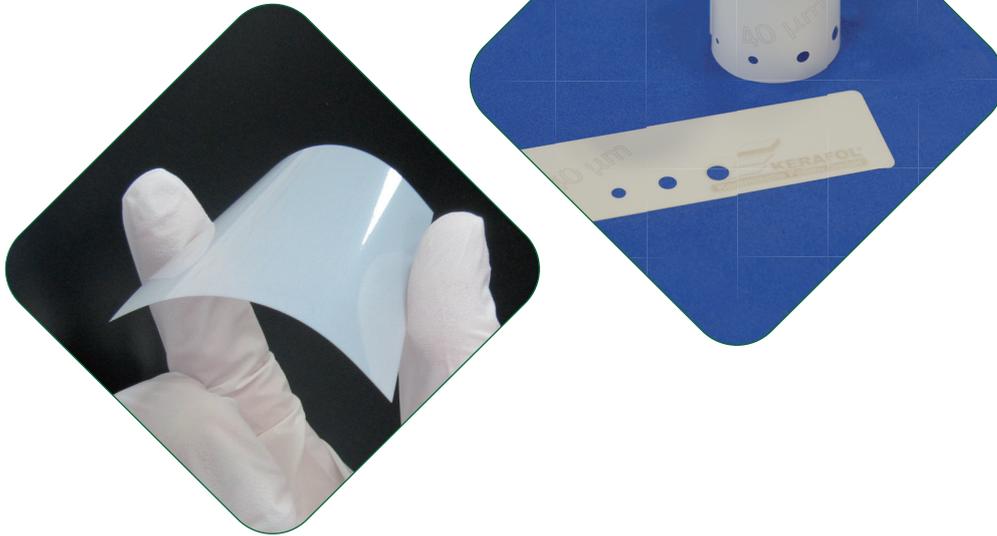
Based on our long experience in the development and production of ceramic tapes for various applications we offer:

- customized tapes and substrates
- consulting & development
- production services from lab scale to mass production



Thin Zirconia Substrates

3 mol-% yttria stabilized zirconia – 3YSZ



Characteristics	Unit	Value
Colour	-	White
Density	[g/cm ³]	6.0
Surface	-	as fired
Surface roughness R _a	[nm]	~ 50
Evenness	[µm]	< 20
Bending strength	[MPa]	600
Dielectric strength at 20°C	[kV/mm]	60
Thermal conductivity	[W/mK]	2
Thermal expansion coefficient	[10 ⁻⁶ /K]	~ 12
Thickness	[µm]	40
Max. available dimension	[mm ²]	150 x 150 (laser cutting to customer specified geometries possible)
Main components	-	ZrO ₂ , Y ₂ O ₃

Originally developed as a thin electrolyte for solid oxide cells, those substrates are excellently suited for electronics applications as well. Their low thickness, high planarity and great flexibility make them a perfect choice for thin film processes or curved fittings.



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For a highly efficient energy conversion.

We are looking forward to receiving your inquiry!

KERAFOL® offers different components in the field of solid oxide fuel and electrolysis cells, which convert chemical energy into electrical energy or vice versa.

Discover our wide range of products and take advantage of the diverse application possibilities!