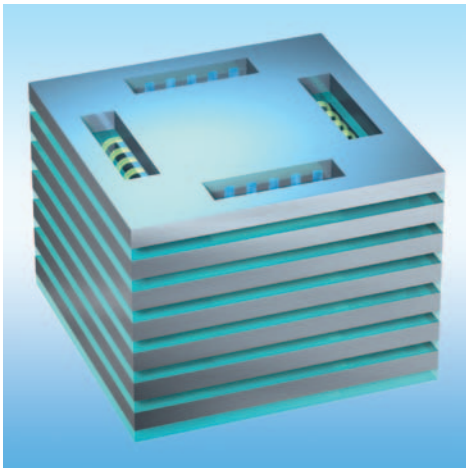
Glass and Glass Ceramic Sealants for Solid Oxide Fuel Cells

Product Information

Solid Oxide Fuel Cells (SOFC) are considered one of the most promising methods for the efficient and environmentally-friendly production of energy. The high operating temperature of 650 °C to 850 °C and the aggressive atmospheres within the cell (fuel, air and humidity) make high demands on all materials used. For the secure and stable combination of multiple cells into a high-performance cell-stack, the metallic layers that serve as interconnects between the individual cells require hermetic protection.

SOFC sealing materials are specially formulated glasses and glass ceramics that withstand the harsh environments and high operating temperatures of SOFCs. Sealing glasses are applied in the form of a paste made of glass powder and an organic binding agent and are dispensed along the critical areas to the interconnects.

Besides providing hermetic sealing for the interconnects to prevent fuel-oxidant mixing, the sealings also serve as electrical insulation with a high electrical resistance at operating temperatures. Moreover, they feature chemical stability under reducing and oxidizing atmospheres and have a matched coefficient of thermal expansion (CTE) to prevent material stress within the structure.



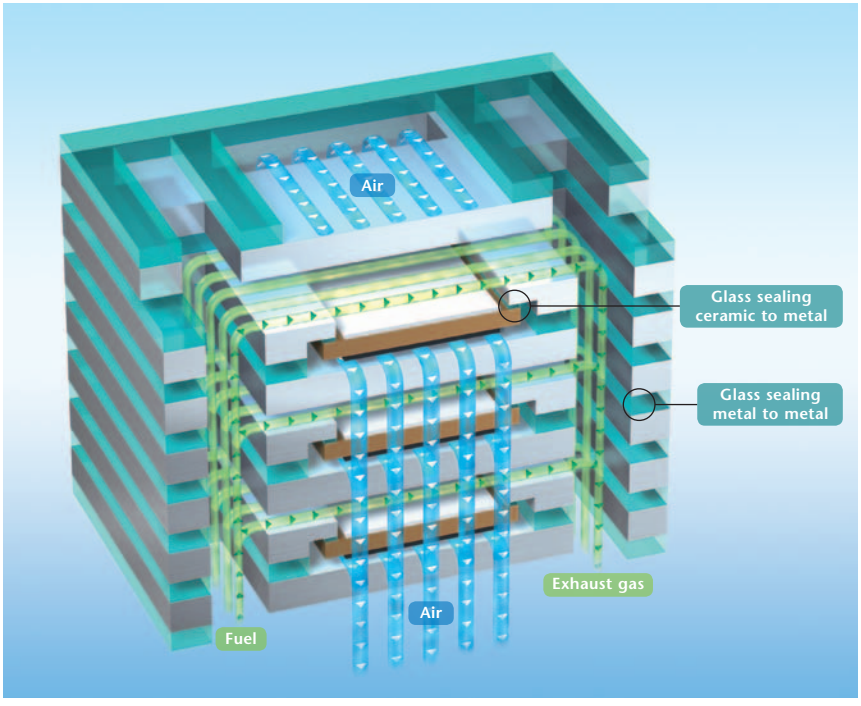
Solid Oxide Fuel Cell

Advantages

- Ideal thermal cycling achieved by perfectly matched CTE to the interconnects and ceramic components
- Crystallizing glasses and glass ceramic composites with a stable structure for constant long-lasting properties
- High amorphous glass phase for "self-healing" characteristics
- Usage of materials with a broad range of sealing temperatures available
- Excellent electrical insulation
- Alkaline free

Cell and stack sealing for different SOFC end applications

- Stationary power supply
- Micro-CHPs (combined heat and power) for homes
- Mobile applications for cars, trucks, campers and vessels



Glass and Glass Ceramic Sealants

SCHOTT
glass made of ideas

Glass and Glass Ceramic Sealants for Solid Oxide Fuel Cells

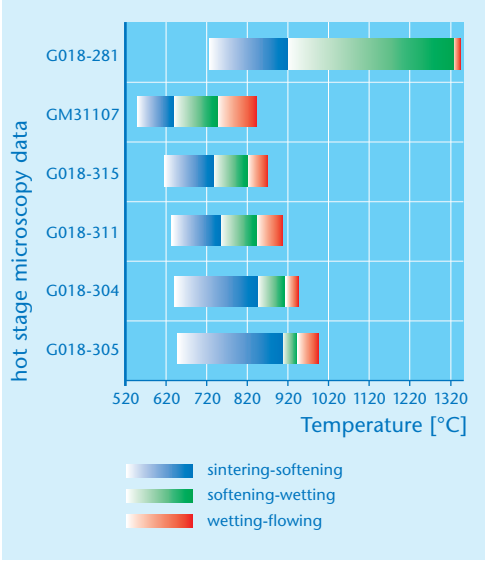
Physical properties of SCHOTT sealing materials

No.		1	2	3	4	5	6
SCHOTT Glass Code		G018-281	GM31107	G018-315	G018-311	G018-304	G018-305
Type		glass	glass	glass ceramic	glass ceramic	glass ceramic composite	glass ceramic composite
$\alpha_{20\text{-}300}$ (10^{-6}/K)		4,6 (glassy)	9,96 (glassy)	9,81 (p.c.)**	9,1 (glassy) 9,8 (p.c.)**	9,5 (p.c.)**	10,31 (p.c.)**
$\alpha_{20\text{-}750}$ (10^{-6}/K)		–	–	11,78 (p.c.)**	–	12,66 (p.c.)**	13,15 (p.c.)**
Tg (°C)		652	532	567	622 (glassy) 614 (p.c.)**	620	595
ρ (g/cm³)		2,7	3,7	3,7	3,8	3,4	3,5
T_x (°C)		–	620*	725*	808	760	769
Temperature at η 10^4 dPas		1196	750	–	873	–	–
hot stage microscopy data	Sintering temp.	737	557	619	669	658	660
	Softening temp.	927	649	739	770	858	908
	Hemisphere temp.	1270	750	823	853	917	944
	Flowing temp.	1333	844	872	904	942	991

** Analyzed by hot stage microscopy data, ** partially crystalline*

SCHOTT – A Reliable Supplier and Development Partner

- Reliable supplier of specialty glass products from laboratory to large scale production
- Competent and flexible development partner of the SOFC industry
- Development of customized solutions



Different behaviors of SCHOTT sealing materials

About SCHOTT Electronic Packaging

SCHOTT's Electronic Packaging is a worldwide leading supplier of hermetic packaging solutions for the reliable, long-term protection of sensitive electronic devices. Since the 1930s, SCHOTT has been developing, manufacturing and optimizing hermetic packages and feedthroughs by using specialized glass, glass-to-metal and today also ceramic-to-metal sealing technology. More than 600 scientists and engineers work with SCHOTT customers all over the world, while setting the pace by developing new, cutting edge technologies for the requirements of today and tomorrow.

With 1,500 employees at five production locations and numerous competence centers in North America, Europe and Asia, SCHOTT Electronic Packaging is a strong and reliable partner for customers worldwide. Products are produced at company sites in Germany, the Czech Republic, Singapore, U.S.A. and Japan.

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