



## Glass-ceramics for efficient fuel cells

### SCHOTT supplies key component for the environmentally-friendly form of power generation using SOFCs

(Landshut, Germany) October 5, 2009 – SCHOTT is increasing its commitment to “green technologies”. The international technology group has developed extremely heat-resistant glass and glass-ceramics as long-lasting sealing materials for high temperature fuel cells. With an operating temperature of between 650°C and 850°C, Solid Oxide Fuel Cells (SOFC) generate electricity and heat in a highly efficient manner. They are used all over the world in small power stations, domestic power supplies and as auxiliary power generators for vehicles.

Our atmosphere continues to heat up. This is mainly caused by the high levels of CO<sub>2</sub> emissions that result from the combustion of fossil fuels. According to the International Economic Platform for Renewable Energies (IWR), despite the prices of fossil fuels climbing to new heights, the global output of greenhouse gas rose by nearly 40 percent from 1990 to 2008. The key to sustainable and environmentally-friendly growth lies in energy efficiency. Here, the fuel cell, and particularly the Solid Oxide Fuel Cell (SOFC), represents a promising solution.

Hydrogen is the source of energy for the fuel cell. Nevertheless, this gas only occurs on earth in a chemically bound form. It is won using renewable or fossil energy sources. Although an infrastructure for supplying hydrogen on a comprehensive basis has not yet been established, an SOFC is able to internally reform fossil fuels such as natural gas, biogas, fuel oil or diesel directly into usable energy. This gives this technology an important competitive advantage.

**SCHOTT AG**  
**SOFC-XI**  
**11<sup>th</sup> International**  
**Symposium for Solid**  
**Oxide Fuel Cells in the**  
**framework of the 216th**  
**Meeting of the ECS**  
**Electrochemical**  
**Society in**  
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**SCHOTT AG**  
Hattenbergstrasse 10  
55122 Mainz  
Germany  
Phone +49 6131/66-2411  
Email [info.cpr@schott.com](mailto:info.cpr@schott.com)  
Internet [www.schott.com](http://www.schott.com)



### **Fast retrofitting in industry and households possible**

SOFCs can be attached directly to the connections for fossil fuels that are already being used in industry, as well as roughly half of all households in Germany and many other countries around the world. Natural gas is particularly well-suited as an energy supplier. The gas mainly consists of methane, which, in turn, is composed of one carbon and four hydrogen atoms. It offers an extremely advantageous hydrocarbon ratio and thus a high energy yield.

SOFC technology is attributed with having the greatest potential for covering the energy requirements of the industrial, commercial and domestic sectors in an environmentally-friendly manner in the future. The galvanic cell converts approximately 80 percent of the chemical energy into usable electricity and heat. Its advantages include high efficiency, flexibility with respect to selecting the type of fuel, and extremely low CO<sub>2</sub> emissions. Water is even the fuel cell's main waste product.

### **The high temperature fuel cell is “ready for the mass market”**

"The infrastructure already exists and in terms of the technology, as well, the SOFC is basically now ready for the mass market," explains Claire Buckwar, Director of Marketing at SCHOTT Electronic Packaging, the leading manufacturer of powders made from glass and glass-ceramics for hermetic encapsulation and passivation of electrotechnical components. "Manufacturers of high temperature fuel cells now need suitable industrial partners who meet the highest international quality standards and offer high security of supply."

This is why SCHOTT has developed special glass and glass-ceramic seals that are perfectly suited for the high operating temperatures of the SOFC of between 650 and 850°C with respect to their physical and chemical properties. The coefficients of thermal expansion have been selected to suit those of the cell and interconnector materials. This allows for the stresses that result when the hermetically sealed glass-to-



#### **SCHOTT AG**

Hattenbergstrasse 10  
55122 Mainz  
Germany

Phone +49 6131/66-2411

Email [info.cpr@schott.com](mailto:info.cpr@schott.com)

Internet [www.schott.com](http://www.schott.com)

metal connections cool down to be reduced. In addition, the seals have a defined crystal phase in order to increase the thermal stability of the seals.

### **Hermetically sealed, even at the highest temperatures**

"The high operating temperatures of the Solid Oxide Fuel Cell place huge demands on the material that is used. Therefore, in order for the cell to be able to generate energy both reliably and efficiently over the long term, the gas channels at the anode and the cathode and the interconnectors of the fuel cell stacks must be hermetically sealed and partially electrically insulated," explains Dr. Jörn Besinger, Director of Development at SCHOTT in Landshut (Germany).

In many ways, fuel cells function like batteries that have a continuous fuel supply. Today's high temperature fuel cells usually consist of flat galvanic cells that are stacked together in order to achieve higher energy performance. The layout of the fuel and air supply elements on the macroscopic and microscopic scales, as well as the sealing and bonding technology used in the stack components with glass-ceramic soldering, represents a basic prerequisite to ensuring that the cells perform for sustained periods.

### **A 125-year history of innovation**

SCHOTT Electronic Packaging (EP), with its headquarters in Landshut (Germany) and Singapore, is the leading manufacturer of special glass powders with unique physical and chemical properties. With its many competence centers around the world, SCHOTT EP offers the most modern glass and glass-ceramic powders and pastes for the hermetic encapsulation and passivation of electronic components. The company that is part of the international SCHOTT technology group and has approximately 17,300 employees all over the world relies on 125 years of experience in the development, manufacturing and reliable supply of special solutions for customers around the globe.



#### **SCHOTT AG**

Hattenbergstrasse 10  
55122 Mainz  
Germany

Phone +49 6131/66-2411

Email [info.cpr@schott.com](mailto:info.cpr@schott.com)

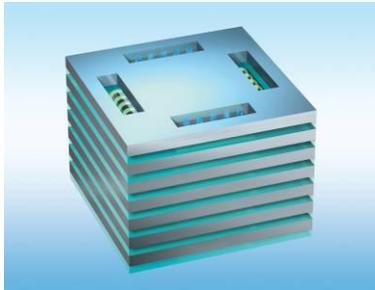
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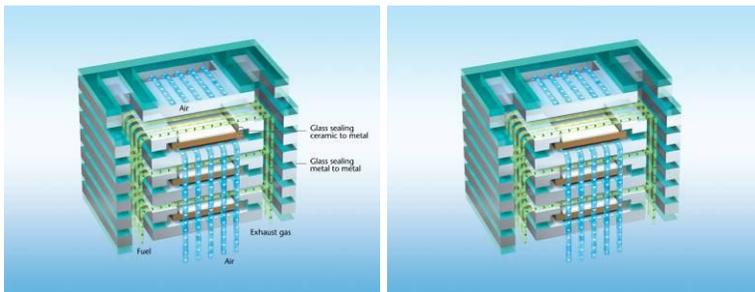
SCHOTT is an international technology group that sees its core purpose as the lasting improvement of living and working conditions. To this end, the company has been developing special materials, components and systems for 125 years. The main areas of focus are the household appliances industry, pharmaceuticals, solar energy, electronics, optics and the automotive industry. The SCHOTT Group is present in close proximity to its customers with production and sales companies in all its major markets. The Group's approximately 17,300 employees generated worldwide sales of approximately 2.2 billion Euros in the fiscal year 2007/2008. The company's technological and economic expertise is closely linked with its social and ecological responsibility. The SCHOTT AG is an affiliate of the Carl-Zeiss-Stiftung (Foundation).

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Download link to a ZIP file that contains the picture in printable quality: <http://tinyurl.com/SCHOTT-SOFC>



Picture no. 235984: The international technology group SCHOTT has developed extremely heat-resistant glass and glass ceramics as long-lasting sealing materials for high temperature fuel cells. With an operating temperature of between 650°C and 850°C, Solid Oxide Fuel Cells (SOFC) generate electricity and heat in a very efficient way. They are used all over the world in small power stations, domestic power supplies and as auxiliary power generators for vehicles. Source: SCHOTT



Picture no. 235994, 236018: Today's high temperature fuel cells usually consist of flat galvanic cells that are stacked together in order to achieve higher energy performance. The layout of the fuel and air



**SCHOTT AG**  
Hattenbergstrasse 10  
55122 Mainz  
Germany  
Phone +49 6131/66-2411  
Email [info.cpr@schott.com](mailto:info.cpr@schott.com)  
Internet [www.schott.com](http://www.schott.com)



supply elements on the macroscopic and microscopic scales, as well as the sealing and bonding technology used in the stack components with glass-ceramic soldering by SCHOTT, represents a basic prerequisite to ensuring that the cells perform for sustained periods.  
Source: SCHOTT

More press pictures can be downloaded at:  
[www.schott-pictures.net](http://www.schott-pictures.net)

**Contact:**

SCHOTT AG  
Christine Fuhr  
PR Manager  
Corporate Public Relations  
Phone: +49 (0)6131/66-4550  
Fax: +49 (0)6131/66-4041  
e-mail: [christine.fuhr@schott.com](mailto:christine.fuhr@schott.com)  
Internet: [www.schott.com](http://www.schott.com)

**Agency Contact:**

oha communication  
Oliver Hahr  
PR Consultant  
Phone: +49 (0)711/5088 6582-1  
Fax: +49 (0)711/5088 6582-9  
e-mail: [oliver.hahr@oha-communication.com](mailto:oliver.hahr@oha-communication.com)  
Internet: [www.oha-communication.com](http://www.oha-communication.com)



**SCHOTT AG**  
Hattenbergstrasse 10  
55122 Mainz  
Germany  
Phone +49 6131/66-2411  
Email [info.cpr@schott.com](mailto:info.cpr@schott.com)  
Internet [www.schott.com](http://www.schott.com)