

## AKE 2 Brennstoffzellen

Zeit: Montag 14:45–15:45

Raum: L

AKE 2.1 Mo 14:45 L

**Operational Data for SOFC operated with Simulated Gasoline Reformate and Pure Carbon Monoxide** — •HOLGER APFEL<sup>1</sup>, ULRICH STIMMING<sup>1,2</sup>, and CARSTEN CREMERS<sup>2</sup> — <sup>1</sup>Department of Physics E19, TU Munich, James-Franck-Str. 1, D-85748 Garching — <sup>2</sup>ZAE Bayern, Walther-Meißner-Str. 6, D-85748 Garching

Solid oxide fuel cells (SOFCs) are a promising technique to efficiently convert fuels available today like gasoline. Nevertheless, most of the data currently published for SOFC refers to the operation with hydrogen and air.

In order to get a database to predict the cell performance using reformate based on the cell performance measured with hydrogen, SOFCs were operated in a single cell configuration with synthetic reformate. Gas compositions were chosen according to the gas compositions measured at the output of an autothermal reformer. The cell output with reformate was related to the output obtained with a reference fuel (91% hydrogen). For all relevant compositions the cell power output with reformate exceeded 80% of the reference value.

Furthermore, cells were fuelled with pure carbon monoxide and oxygen and run at 0.7 V. All cells showed an initial increase in current density, followed by a decrease which seems to stabilize at about 60% of the maximum current. Afterwards the cells were inspected by SEM revealing changes in the cell structure, especially near the gas input and along the flow field channels.

\1\ PhD thesis Maria Brandmaier, TU Munich, 2005

AKE 2.2 Mo 15:05 L

**Experimentelle Untersuchung des Wasser- und Wärmeaustrages an der DMFC-Kathode** — •CHRISTIAN KIRCHHOFF<sup>1</sup>, CARSTEN CREMERS<sup>1</sup>, ULRICH STIMMING<sup>1,2</sup> und MATTHIAS RZEPKA<sup>1</sup> — <sup>1</sup>ZAE Bayern, Walther-Meißner-Str. 6, D-85748 Garching — <sup>2</sup>TU München, Physik-Department E19, James-Franck-Str. 1, D-85748 Garching

Die Leistungsdichte von Direktmethanol-Brennstoffzellen (DMFC) ist stark temperaturabhängig. Gerade kompakte Systeme für portable Anwendungen könnten daher von einer Erhöhung der Betriebstemperatur profitieren. Hierzu muss jedoch gewährleistet sein, dass die Grenzwerte für zulässige Oberflächentemperaturen und Austrittstemperaturen der Abgase eingehalten werden können. Weiterhin muss das System so ausgelegt werden, dass es die vorgesehene Temperatur erreichen und halten kann. Ein wesentlicher Faktor für beide Randbedingungen ist der Austrag von dampfförmigem Wasser mit der Kathodenabluft, der zu einem starken Wärmeverlust führt. Trotz der Bedeutung des Wasserhaushalts für das DMFC-System, gibt es in der Literatur bislang wenig Daten zum Wasseraustrag und dem damit verbundenen Wärmeverlust. In diesem Beitrag werden systematische Messungen des Wasseraustrages bei verschiedenen Betriebsbedingungen vorgestellt. In zwei Messreihen wurden der dampfförmige Wasseranteil der Kathodenabluft durch Taupunktmessungen bestimmt und der gesamte Wasseraustrag durch Kondensation in einer Kühlfalle gemessen. Zusätzlich wurde durch kalorische Messungen der Wärmeverlust durch den Wasseraustrag experimentell abgeschätzt. Die gewonnenen Daten werden mit Modellrechnungen verglichen.

AKE 2.3 Mo 15:25 L

**Study of ethanol and ethylene glycol by Fuel Cell Differential Electrochemical Mass Spectrometry (FC-DEMS)** — •VINEET RAO<sup>1</sup>, CARSTEN CREMERS<sup>2</sup>, and ULRICH STIMMING<sup>1</sup> — <sup>1</sup>Department of Physics E19, TU Munich, James-Franck-Str. 1, D-85748 Garching — <sup>2</sup>ZAE Bayern, Walther-Meißner-Str. 6, D-85748 Garching

The ethanol and ethylene glycol electro oxidation at gas diffusion electrodes (GDE) made of different catalysts, Pt/C, PtRu/C and PtSn/C, were both studied by on-line differential electrochemical mass spectrometry (DEMS) in a wide temperature range (30-90 °C) as function of the anode potential, the fuel concentration and catalyst loading. CO<sub>2</sub> was observed as doubly ionised carbon dioxide molecular ion at m/z = 22, and acetaldehyde was observed as CHO<sup>+</sup> fragment at m/z = 29. The CO<sub>2</sub> current efficiency (CCE) for ethanol oxidation reaction (EOR) shows a strong dependence on the anode potential, decreasing rapidly with increasing potentials >0.5V RHE. But the CCE for ethylene glycol oxidation reaction (EGOR) is almost potential independent. The CCE for the

EGOR goes down with increase in concentration of ethanol. CCE for both reactions shows a strong dependence on the catalyst layer thickness or catalyst loading, respectively. It increases with increasing catalyst loading. The formation of CO<sub>2</sub> in both reactions is a temperature-activated process with apparent activation energy of 21 kJ/mol. The apparent activation energy for ethanol oxidation is estimated to be 31kJ/mol while 25kJ/mol for ethylene glycol oxidation.