

## Accelerated creep in solid oxide fuel cell anode supports during reduction - DTU Orbit (09/11/2017)

### Accelerated creep in solid oxide fuel cell anode supports during reduction

To evaluate the reliability of solid oxide fuel cell (SOFC) stacks during operation, the stress field in the stack must be known. During operation the stress field will depend on time as creep processes relax stresses. The creep of reduced Ni-YSZ anode support at operating conditions has been studied previously. In this work a newly discovered creep phenomenon taking place during the reduction is reported. This relaxes stresses at a much higher rate ( $\sim \times 10^4$ ) than creep during operation. The phenomenon was studied both in three-point bending and uniaxial tension. Differences between the two measurements could be explained by newly observed stress promoted reduction. Finally, samples exposed to a small tensile stress ( $\sim 0.004$  MPa) were observed to expand during reduction, which is in contradiction to previous literature. These observations suggest that release of internal residual stresses between the NiO and the YSZ phases occurs during reduction. The accelerated creep should practically eliminate any residual stress in the anode support in an SOFC stack, as has previously been indirectly observed. This phenomenon has to be taken into account both in the production of stacks and in the simulation of the stress field in a stack based on anode supported SOFCs. (C) 2016 Elsevier B.V. All rights reserved.

### General information

State: Published

Organisations: Department of Energy Conversion and Storage, Mixed Conductors, Imaging and Structural Analysis, Fundamental Electrochemistry, European Spallation Source ESS AB

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Number of pages: 12

Pages: 78-89

Publication date: 2016

Main Research Area: Technical/natural sciences

### Publication information

Journal: Journal of Power Sources

Volume: 323

ISSN (Print): 0378-7753

Ratings:

BFI (2017): BFI-level 1

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 6.22 SJR 1.945 SNIP 1.483

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 1.945 SNIP 1.686 CiteScore 6.34

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 1.983 SNIP 2.071 CiteScore 6.3

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1

Scopus rating (2013): SJR 1.985 SNIP 2.138 CiteScore 5.63

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 1

Scopus rating (2012): SJR 2.293 SNIP 2.016 CiteScore 5.04

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1

Scopus rating (2011): SJR 2.247 SNIP 2.181 CiteScore 5.13

ISI indexed (2011): ISI indexed yes

Web of Science (2011): Indexed yes

BFI (2010): BFI-level 1

Scopus rating (2010): SJR 2.297 SNIP 1.981

Web of Science (2010): Indexed yes

BFI (2009): BFI-level 1

Scopus rating (2009): SJR 2.117 SNIP 1.793  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 2  
Scopus rating (2008): SJR 1.968 SNIP 1.726  
Web of Science (2008): Indexed yes  
Scopus rating (2007): SJR 1.597 SNIP 1.489  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.8 SNIP 2.224  
Web of Science (2006): Indexed yes  
Scopus rating (2005): SJR 1.65 SNIP 1.825  
Web of Science (2005): Indexed yes  
Scopus rating (2004): SJR 1.852 SNIP 1.818  
Scopus rating (2003): SJR 1.66 SNIP 1.583  
Scopus rating (2002): SJR 1.959 SNIP 1.4  
Web of Science (2002): Indexed yes  
Scopus rating (2001): SJR 1.115 SNIP 1.492  
Scopus rating (2000): SJR 1.106 SNIP 0.914  
Scopus rating (1999): SJR 0.854 SNIP 0.998  
Original language: English  
Creep, Reduction, SOFC, SOEC, Ni-YSZ, Chemo-mechanical coupling  
DOIs:  
10.1016/j.jpowsour.2016.04.097  
Source: FindIt  
Source-ID: 2304469469  
Publication: Research - peer-review › Journal article – Annual report year: 2016