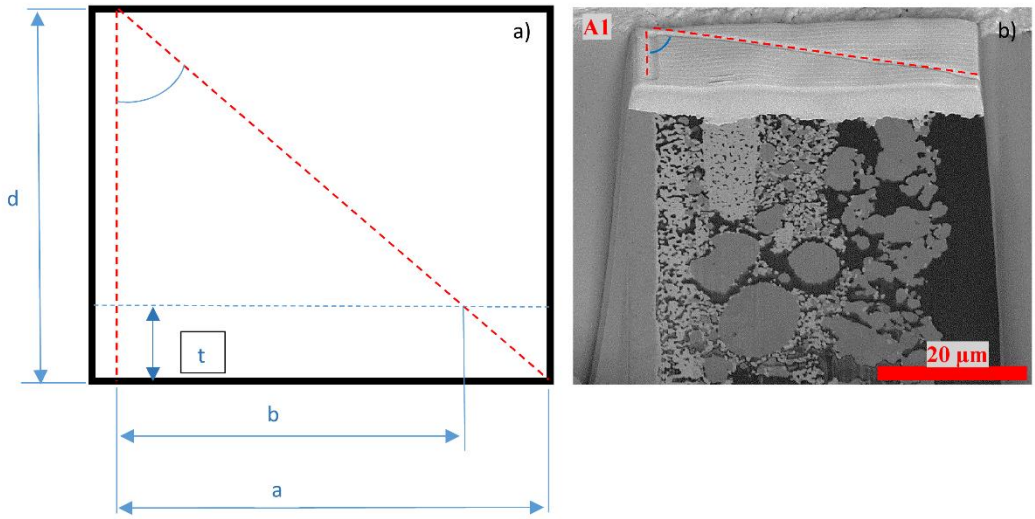
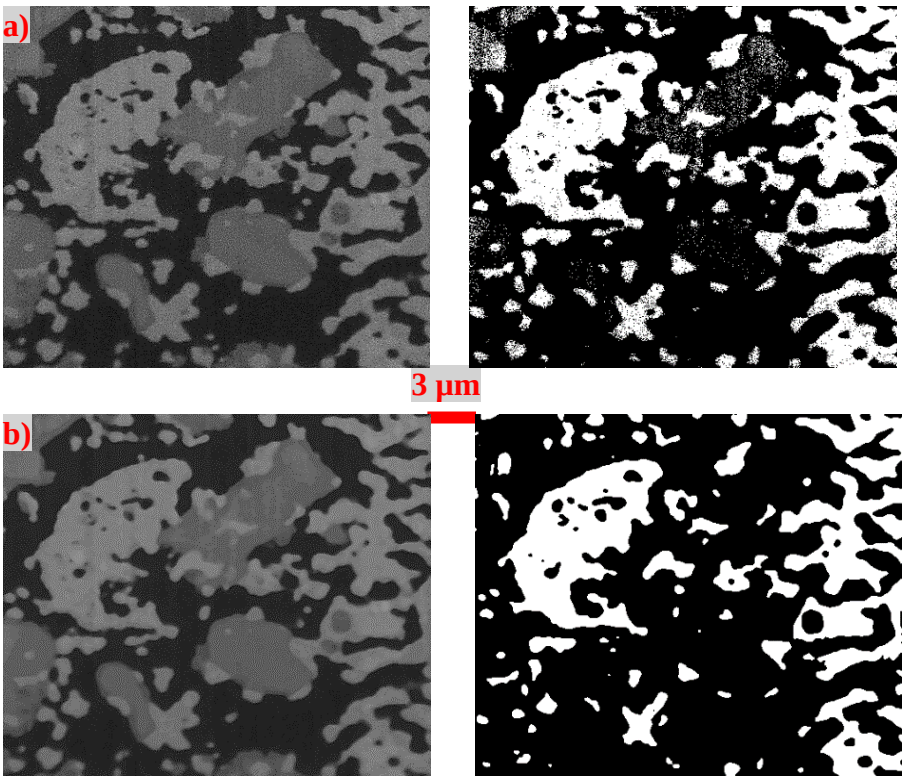
Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

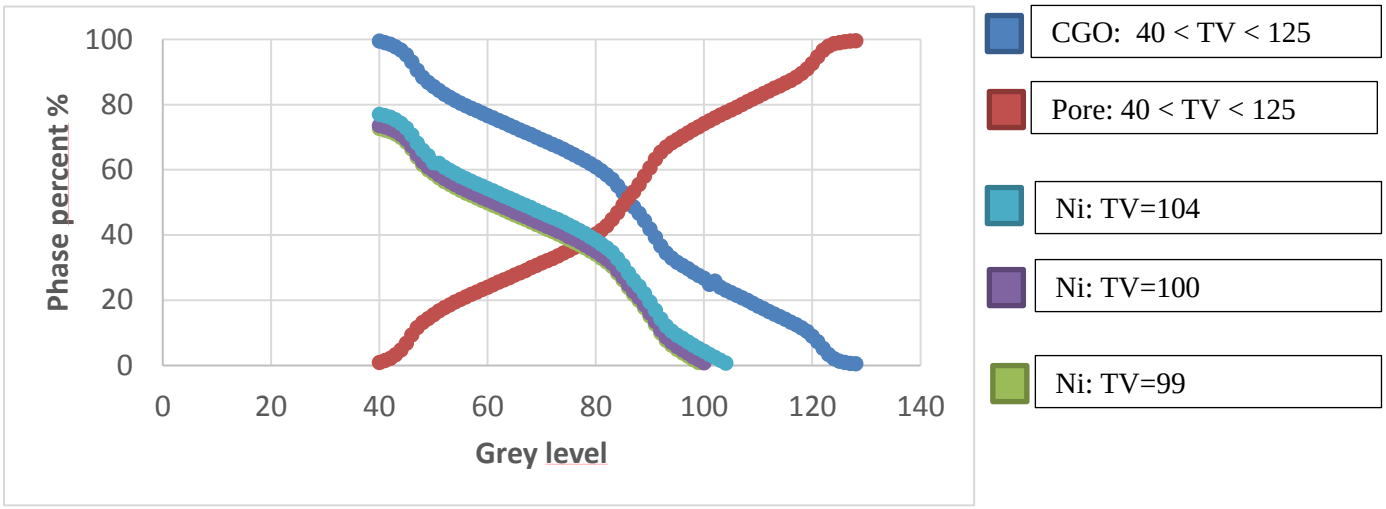
Supplement:



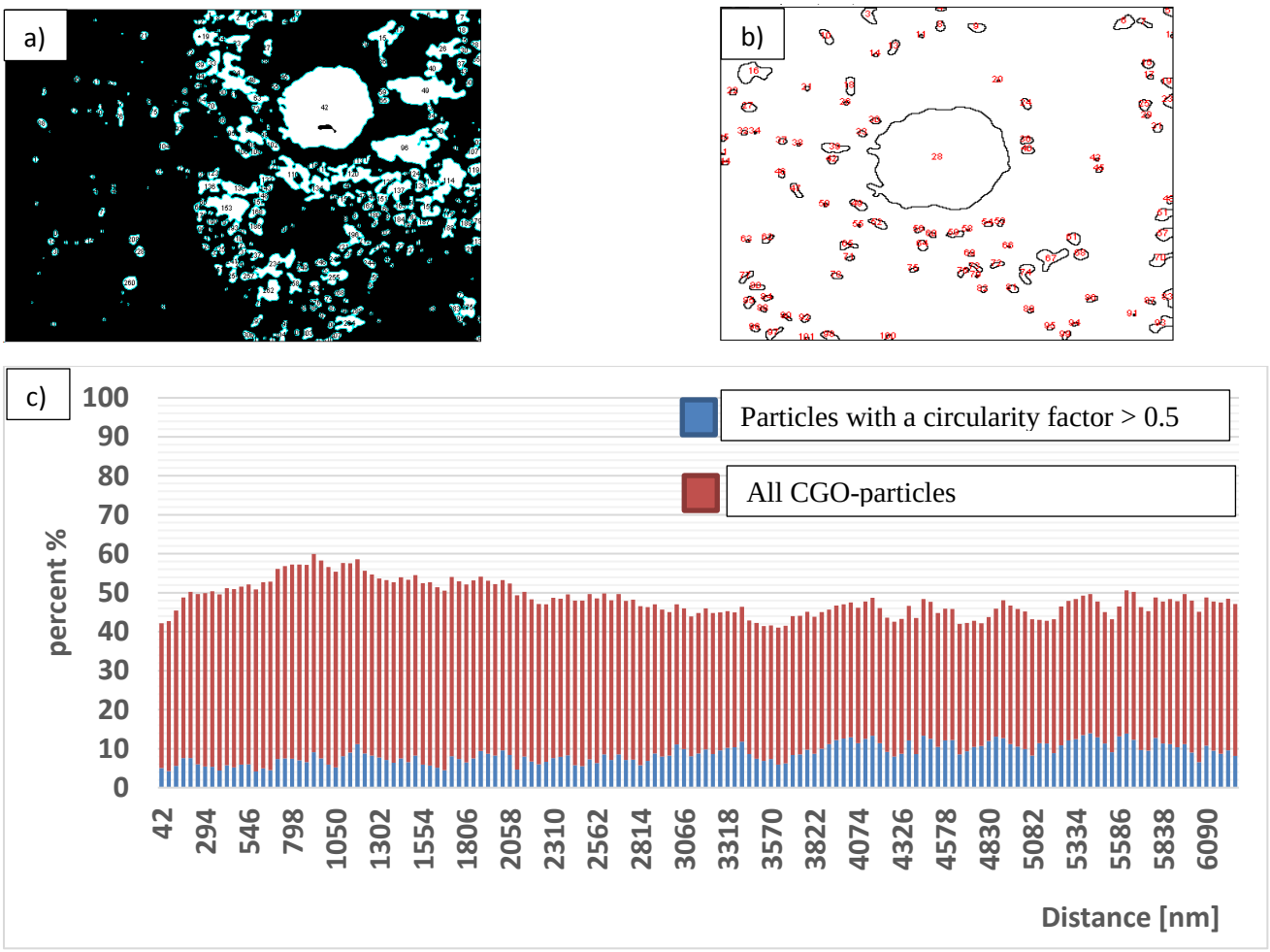
Supplement Figure 1: a) Schematic depiction of markers and the slice thickness measurement method. b) The SEM image of the anode cross section shows the complete anode thickness and a part of the electrolyte.



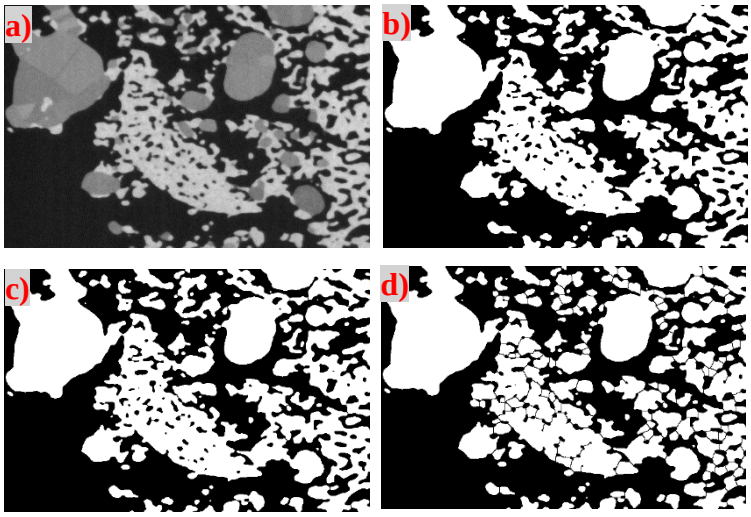
Supplement Figure 2: a) Segmentation of the CGO Phase without using a filter. The use of a small scan rate during imaging lead to a noised image which has influence on the quality of the segmentation. b) Applying the median-filter to remove the noise from images: the noise can be suppressed and the boundaries between different phases remain sharp.



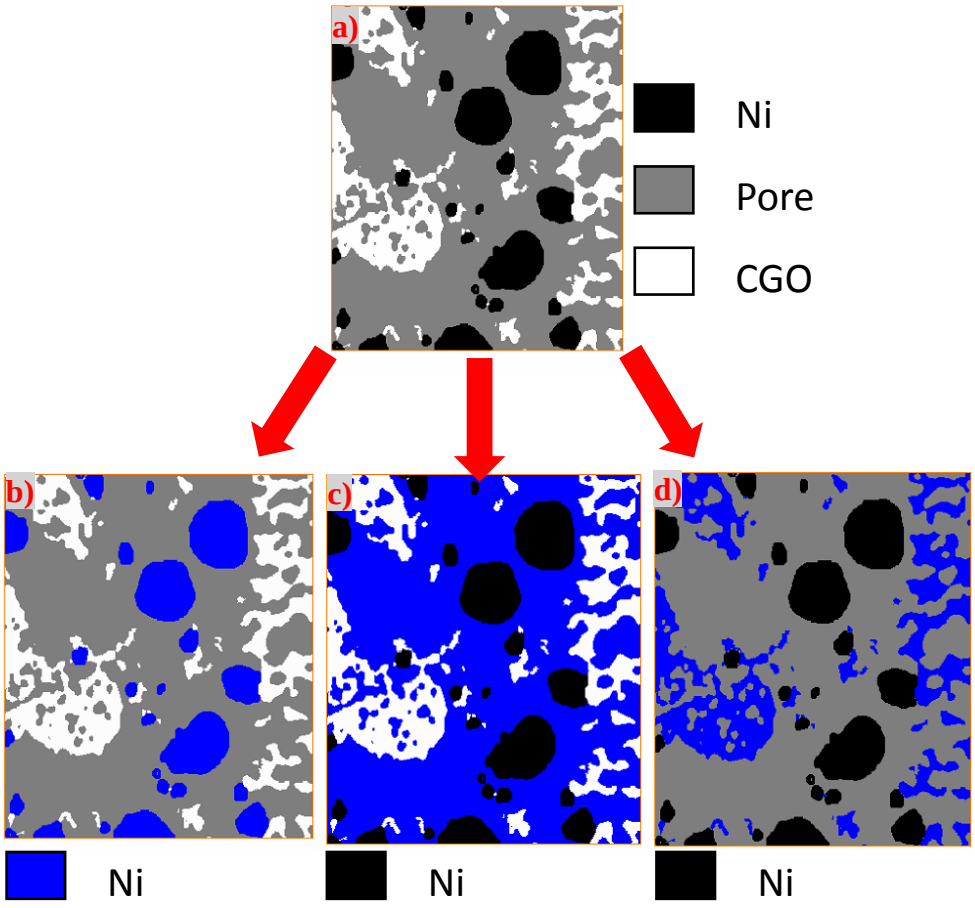
Supplement Figure 3: change of the pore percentage per volume when changing the chosen thresholding.



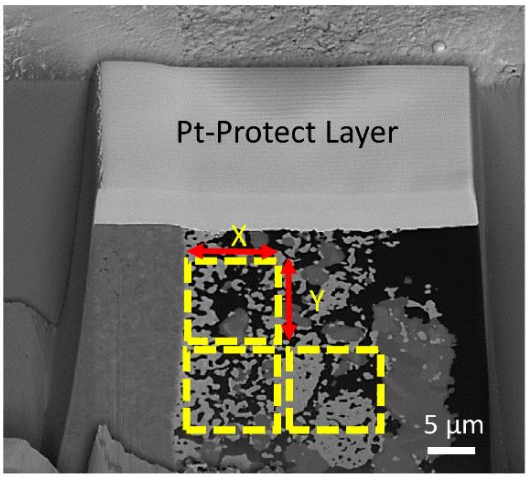
Supplement Figure 4: a) segmented image presenting the CGO-particles in white and the Ni particles as well as pores in black (Background), b) Only the particles that have a circularity factor > 0.5 are drawn, c) a graph illustrates in blue the area of the particles having a circularity > than 0.5 and in orange the area of all particles presented in each 2D-image.



Supplement Figure 5: a) SEM image taken with BSE-detector (3kV) representing the three phases Ni, CGO, and pore b) binary image showing the segmented solid phase c) applied watershed algorithm with a splitting factor of 1 pixel and 5 pixels in (d)



Supplement Figure 6: watershed segmentation steps; (a) ternarized 2D image presenting all phases, (b) segmentation of Ni phase (c) segmentation of pore phase (d) segmentation of CGO phase.



Supplement Figure 7: Position of the three taken volumes from the surface of interest near the interface electrolyte-anode.

Ref.	Autors	Data-Set	Cermet	Resolution			Height [µm]	Volume [μm^3]
				R_x [nm]	R_y [nm]	R_z [nm]		
[1]	J.R. Wilson et al.	2006	YSZ-Ni	---	---	50	3.4	100
[2]	J.R Wilson et al.	2007	YSZ-LSM	10	10	40-50	4	100
[3]	J.R Wilson et al.	2009	YSZ-Ni	13.9	13.9	44	3.5	109
[4]	S. Barnett et al.	2007	YSZ-Ni	---	---	40-50	3.4	100
[5]	J. R Wilson et al.	2009	YSZ-LSM	---	---	53.3	12.9	685
[6]	J.R Wilson et al.	2011	YSZ-Ni	24.8	24.8	50	---	342-671
[7]	D. Gostovic et al.	2007	YSZ-LSCF	3	3	20	3	399-438
[8]	P.R Shearing et al.	2010	YSZ-Ni	20	20	15	1.5	50
[9]	G. J. Nelson et al.	2011	YSZ-LSM	10	10	45	5	125
[10]	G. J. Nelson	2012	YSZ-Ni	32	32	32	6.6	287
[11]	A. Cecen et al.	2012	---	10	10	20	2	80
[12]	Z. Chen et al.	2015	CGO-LSCF	12.5	12.5	12.5	3.11	30
[13]	D. Kennouche et al.	2014	YSZ-Ni	20	20	40	9.8	50
[14]	K. Eguchi et al.	2012	CGO-Ni	14	14	35-60	4.5	280
[15]	J. A. Taillon et al.	2014	LSM-YSZ	---	---	30	4.47	276.84-78.77
[16]	L. Holzer et al.	2004	BaTiO3	6	7	17	1.74	63

Supplement Table 1: Studies with a Volume less than 800 μm^3

Ref.	Autors	Data-Set	Cermet	Volume [μm^3]	Aging-Parameters		
					J [$A.cm^{-2}$]	T [° C]	Time [h]
[17]	L. Holzer et al.	2011	CGO-Ni	5840	---	950	2286
[18]	L. Holzer et al.	2011	CGO-Ni	---	---	950	2000-2300
[19]	G. A. Hughes et al.	2012	YSZ-LSM	>1000	0.5-1.5	800	1000
[20]	M.V. Ananyev et al.	2015	YSZ-Ni	---	---	700-800	3000
[10]	G. J. Nelson et al.	2012	YSZ-Ni	287	---	---	1130
[21]	G. Brus et al.	2015	YSZ-Ni	864	---	800	3700
[22]	E. L. Grindler et al.	2014	YSZ-Ni	---	0.5-0.8	800	1000
[23]	H. Wang et al.	2016	LSCF-CGO	684-745	---	800	800
[24]	Tyden et al.	2008	YSZ-Ni	1688-2100	1-0.68	850	17500

Supplement Table 2: Studies of degradation with 3D-reconstruction method at long operation times

Ref.	Autors	Data-Set	Cermet	Resolution			Height [µm]	Volume [μm^3]
				R_x [nm]	R_y [nm]	R_z [nm]		
[25]	H. Iwai et al.	2010	YSZ-Ni	26.6	26.6	60-72	4.74-6.57	1344-1937
[26]	N. Shikazono et al.	2011	YSZ-Ni	26	26	62	6.20	972
[27]	M. Kishimoto et al.	2012	YSZ-Ni	26.6	26.6	62	6.2	1013
[28]	F. Tariq et al.	2014	Ni-ScSZ	17-30	17-30	17-30	6.5-10	2700-3159
[29]	M. Kubota et al.	2015	YSZ-Ni	26.6	26.6	60-72	4.74-6.57	1344-1937
[30]	M. Kishimoto et al.	2014	CGO-Ni	5-30	5-30	10-62	2.25-6.2	19.2-1013

Supplement Table 3: Studies with a very small height/Base area ratio

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