Impact of the sweep gas on degradation of the $La_{0.6}Sr_{0.4}Co_{0.8}Fe_{0.8}O_3$ anode in solid oxide electrolysis cell.

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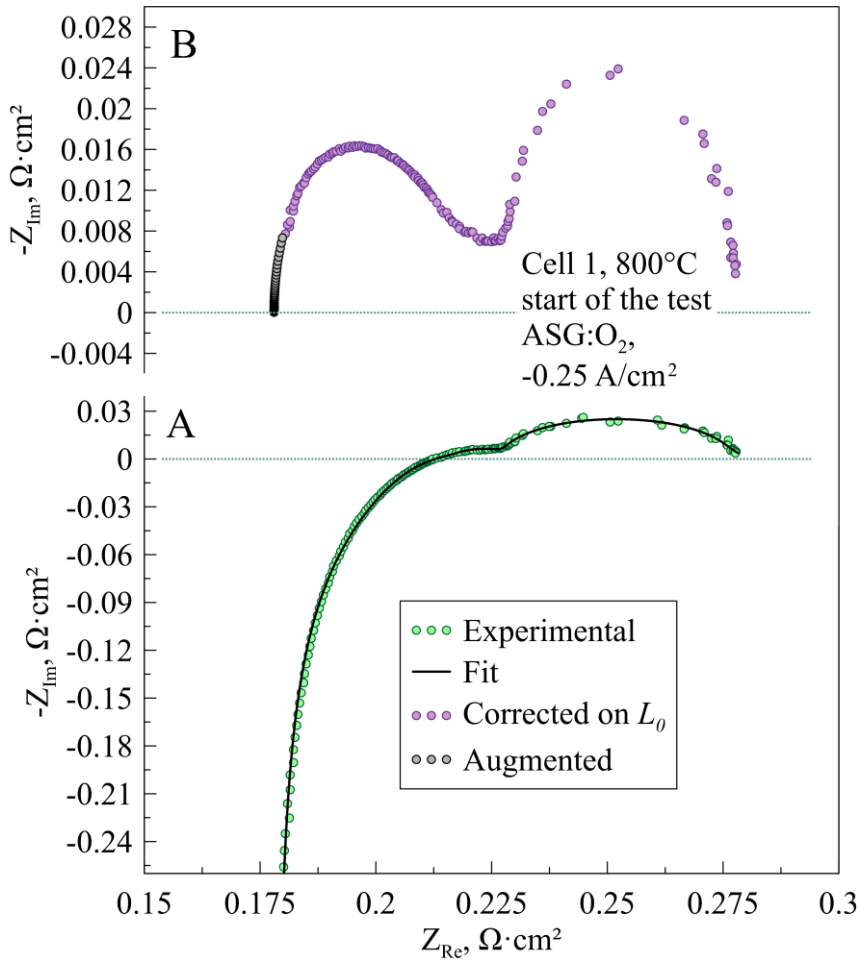


Figure S1. Example of the treatment of the EIS data. A: experimental results and fit of the electrochemical model, which includes chain of the R_Ω, L_0 and 5 RC elements. To assure the compatibility with DRT impedance of the $(RC)_i$ element was represented as $Z_i = \frac{R_i}{1+j2\pi f\tau_i}$, where $j = \sqrt{-1}$, f- frequency, R_i and τ_i – parameters of the element. Fit values presented in **Table S1.**

Table S1. Example of the equivalent circuit fit.

Element	Parameter	Value	Error
R_Ω	R, Ω·cm²	0.1780	0.0005
L_0	L, μH·cm²	1.90	0.04
$(RC)_1$	R, Ω·cm²	0.025	0.001
	τ, μs	23	1
$(RC)_2$	R, Ω·cm²	0.014	0.001
	τ, ms	0.11	0.01
$(RC)_3$	R, Ω·cm²	0.0102	0.0005
	τ, ms	1.236	0.001
$(RC)_4$	R, Ω·cm²	0.0492	0.0006
	τ, ms	59	1
$(RC)_5$	R, Ω·cm²	0.003	0.001
	τ, s	0.9	0.6*
R^2	Total	0.99998	
	Real	0.9998	
	Imaginary	0.99996	
N		155	
χ^2/N_{dof} **		$5.26 \cdot 10^{-6}$	

*High level of the errors in low-frequiency domain originated from the fluctuation of the steam flow

** N_{dof}- number of degrees of freedom.

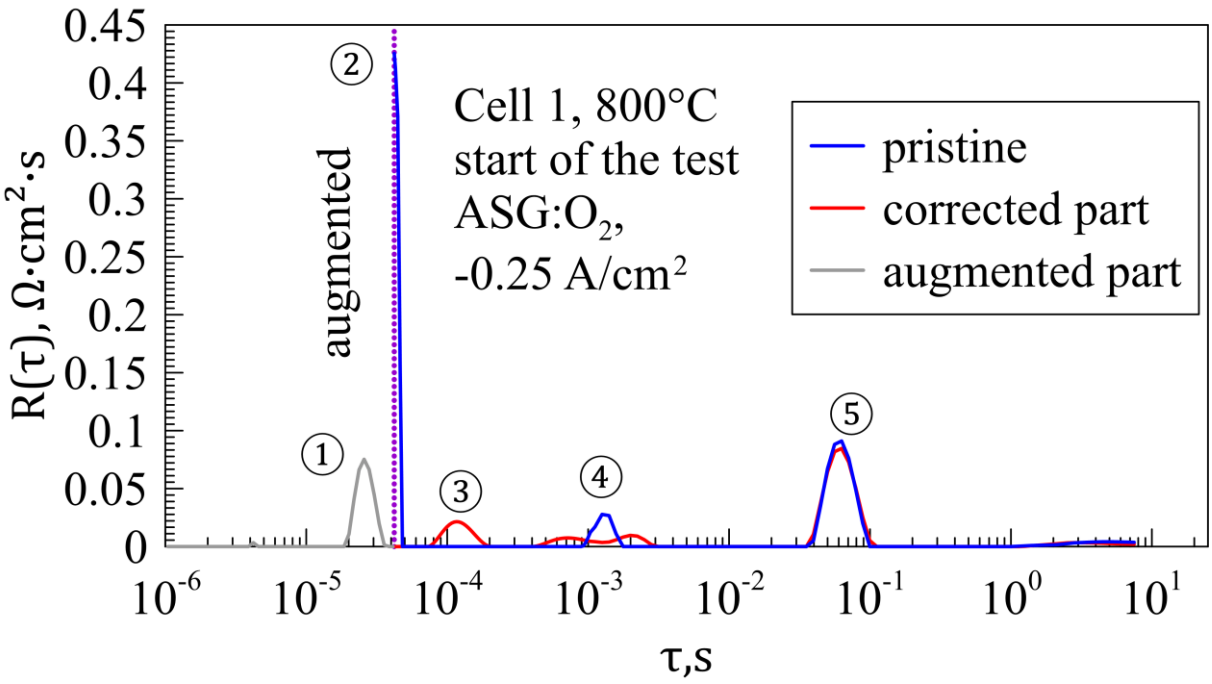


Figure S2. Example of the augmentation of the DRT of the EIS (**Figure S1.**), using equvalent circuit model. Insufficent amount of the data points in high-frequency part of the spectrum, which was hidden with parasitic inductance, resulted in the artefact (2), observed in the priscine DRT. Augmentation of the spectrum using equvalent circuit model led to split of the anomalous peak (2) on reasonable-sized peaks (1) and (3), respectively. As one can note, augmentation practically did not touch "slow" peak (5), but enhanced resolution of the DRT in c.a. two decades, which results in slit of the peak (4).

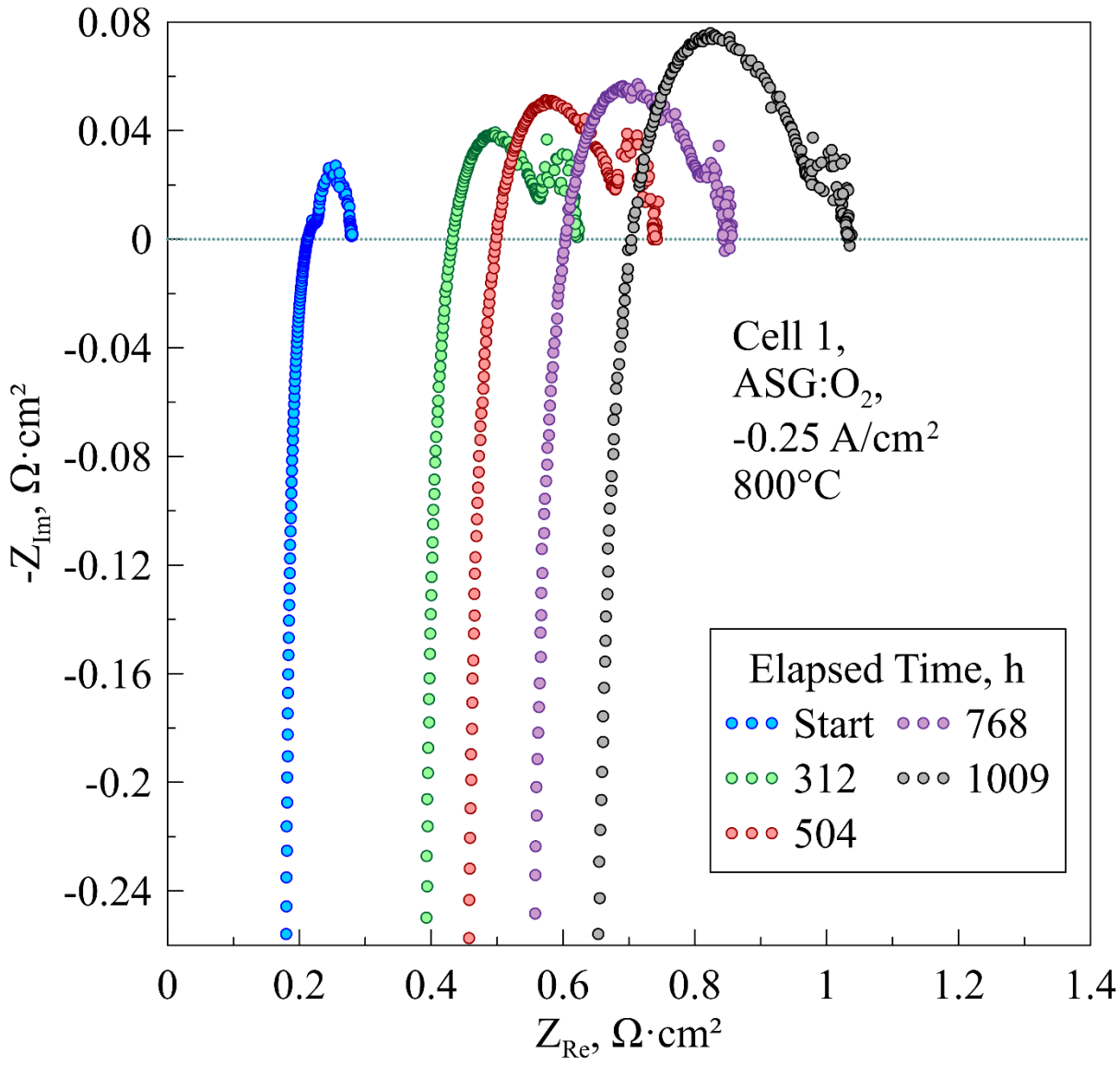


Figure S3. Example of EIS of the Cell 1.

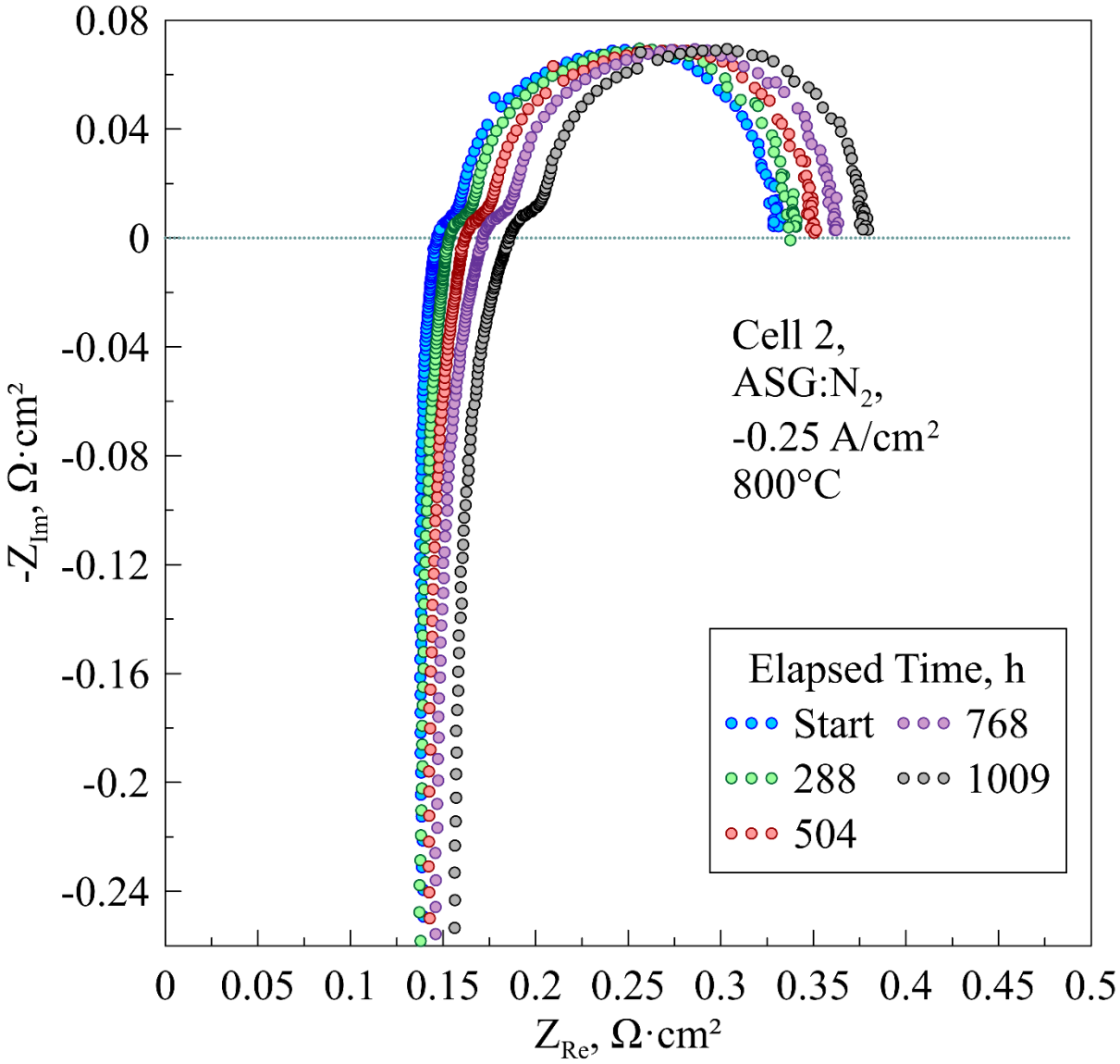


Figure S4. Example of EIS of the Cell 2.

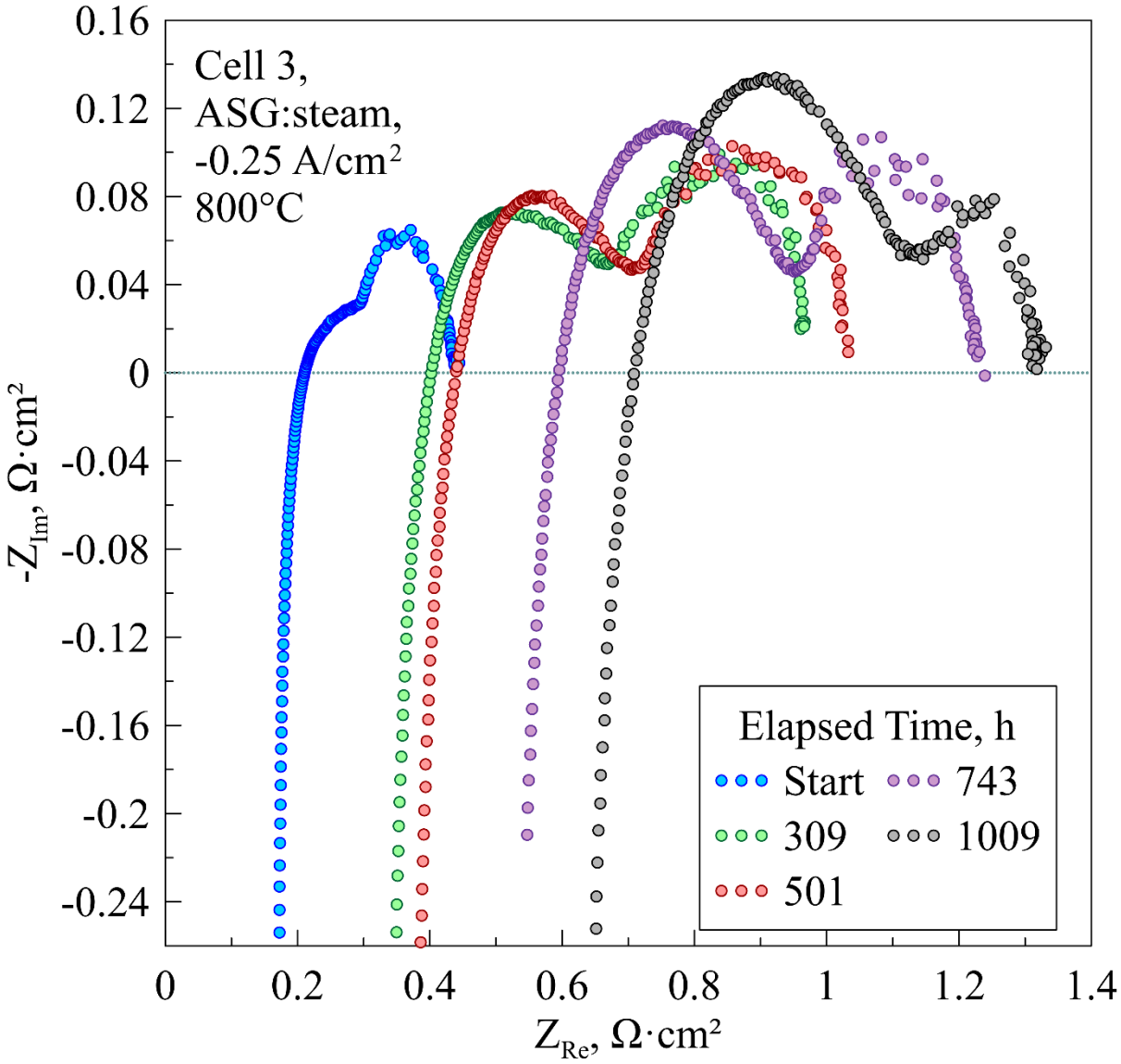


Figure S5. Example of EIS of the Cell 3

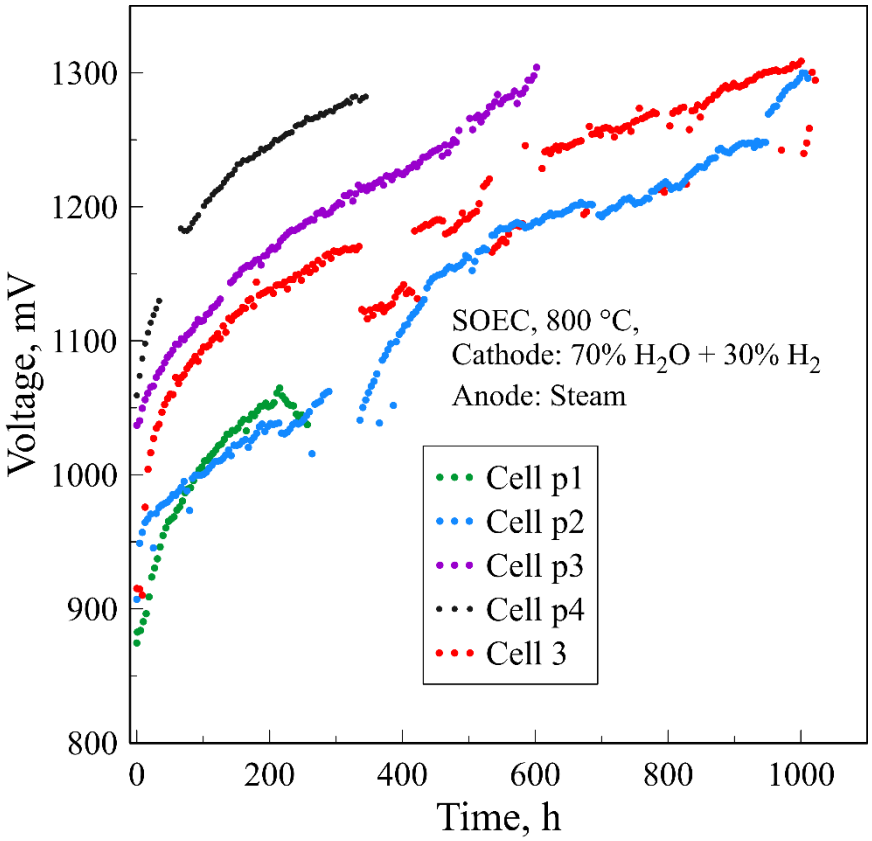


Figure S6. Preliminary (Cells p1-p4) and final (Cell 3) tests of the electrolysis with steam as anode sweep gas. Plots includes each 50th data point. Conditions were similar to the described in the main part of the manuscript. Cells p1-p4 where used in preliminary tests, and numbered in sequience as they were tested. Cells p3-p4 and Cell 3 were based on Elcogen half-cells, while Cells p1 and p2 was acquired from different commercial sources. Cells p1 and p2 demonstrated evidences of the non-electrolytic oxygen transport, Cell p1 failed after c.a. 240 h of measurements. Cells p3 and p4 were ruined after force-majeure events.