

Peer Review

Review of: "Impedance of a Hydrogen–Fed SOFC Anode: Analytical and Numerical Models Based on the Dusty Gas Transport Model"

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The author presents a work on modeling the impedance of a H₂-fed SOFC anode using the dusty gas transport model that takes into account the pressure gradient in the anode support layer. The work includes an analytical expression of the impedance valid for low current densities and a numerical model for high currents. It is shown that neglecting the pressure gradient leads to severe shortcomings (underestimation of H₂ diffusivity, underestimation of transport resistivity...) and shows the limits of using a classical finite Warburg element.

The work is well-written, clear, and extensively explained. All model derivations and underlying hypotheses are explained in detail. The results and conclusions are relevant. My remarks are minor and are mainly intended to clarify the presentation of the work.

- Page 8/9: it is stipulated that Y_1 , P_1 , and E_1 are given by equation (24). On the other hand, this equation does not involve an index.

- Page 11, last line: in the sentence “both the impedances...” “the” can be removed, in my opinion.

- Page 15/16: it is concluded that neglecting the pressure gradient leads to an underestimation of the diffusion coefficient of hydrogen. Figure 5 then shows that the transport resistance is higher when the pressure gradient is taken into account. As I understand it, this should lead to a decrease in diffusion compared to the model with constant pressure. This would merit clarification.

- Page 17: to fit the spectra with the analytical model, the exchange current i^* is imposed by equation (39). This significantly impacts the values of the estimated parameters, as rightly mentioned. Why is i^* imposed and not used as a parameter to be estimated by fitting?

- Page 19: equation (40) is presented as a criterion for being able to neglect the pressure gradient in the modeling. What does it represent, i.e., what physical phenomena are compared by this ratio?
- In this paper, only the analytical model is used to interpret experimental data. It would be interesting to add a study of measurement data using the numerical model in order to validate the present model over the entire range of currents.

Declarations

Potential competing interests: No potential competing interests to declare.