# MODELLING OF CROSS-FLOW STACK: SENSITIVITY TO THERMAL PROPERTIES OF THE MATERIALS

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LENI activities in SOFC are focused on development of a new planar stack concept based on anode supported cells in collaboration with the company HTceramix SA. Modeling of repeat element, stack and systems is starting in parallel. This work presents a model of a SOFC stack in cross flow configuration. Concentration, temperature and current density fields are computed, with a focus on sensitivity study for thermal parameters, while operating parameters are kept constant for the different cases.

The main parameter considered was the thickness of the metallic interconnect and the related thermal conductivity. Stack height and cell size effects are presented as well. Importance of the temperature field on the design point and degradation behavior is briefly discussed. Figure 1 shows a temperature profile obtained for a 100 $\mathrm{cm}^2$ cell.

The main parameter considered was the thickness of the metallic interconnect and the related thermal conductivity. The figure 2 shows the temperature sensitivity (@ the cell center) with the thermal conductivity on the $\mathrm{x}$ and $\mathrm{y}$ plane for different stack height. This shows clearly the effect of the increasing thermal conductivity, which decreases the temperature. On the other hand the temperature increases with increasing number of cells, but no adiabatic cell are found for stacks up to 51 cells. This is mainly due to quite high thermal conductivity for the case simulated. In fact, the current collectors are metallic nipples machined on the interconnects, this makes that most of the conduction path on the height of the stack is through metallic and thermal conductive material.

Finally, the effect of the cell size on the temperature is studied for three different cell sizes at the same average current density and the same fuel utilization. The temperature profiles found are similar but the maximum temperature increases (see figure 3) with the cell size.

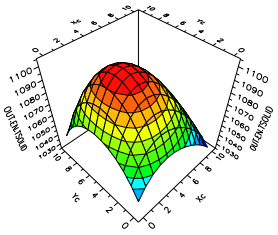

**Figure 1: Temperature profile for the mid cell of a 21 cells stack case high conductivity**

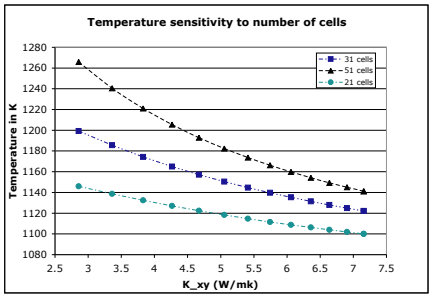


**Figure 2: Sensitivity of temperature to the thermal conductivity**

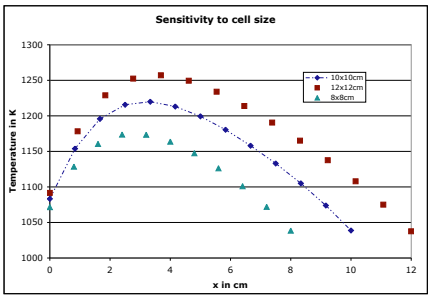


**Figure 3: Temperature profiles for 3 cell size**