which proves that the Ohmic heat source is the most likely of the overheating of AS-IT-SOFC. Figure10.

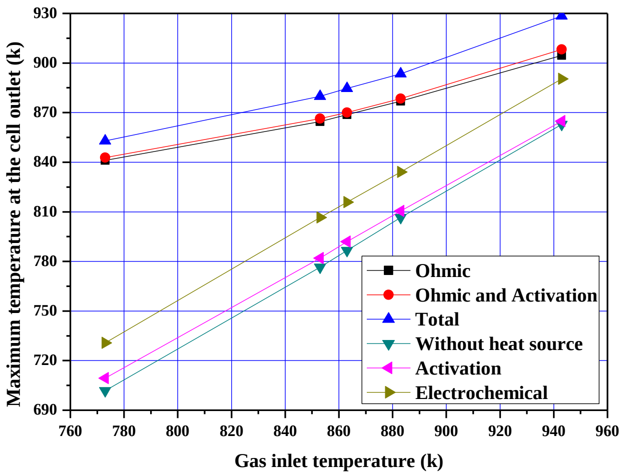

Figure 10. Evolution of the maximum temperature at the cell outlet according to the gas inlet temperatures

4. CONCLUSIONS

In this work, we present a thermal study of the heat production phenomenon in an elementary cell of a planar AS-IT-SOFC. Our objective is to obtain and determine the impact and contribution of each heat source (Ohmic, activation, concentration and electrochemical) on the distribution and elevation of the temperature values in all parts of the AS- IT-SOFC (electrolyte, anode, cathode, the two anodic and cathodic interconnectors and the two channels). The results are obtained using a FORTRAN language program developed locally, which is based on the modeling of the governing equations of the equilibrium heat transfer phenomenon in a three-dimensional environment using the finite differences method according to a centered scheme.

The obtained results for the cases which consider the heat production by the Ohmic sources, the sum of the two sources Ohmic and activation and the total source show that the highest temperatures are localized in the zones of the electrolyte farthest from the channels that are in the neighboring the cathode at the cell output. The lower temperatures are positioned at the inlet of the two anodic and cathodic channels. For the case that considers heat production by concentration, activation and electrochemical sources, the lower temperatures are localized at the cell output in the electrolyte zones farthest from the channels that are closer to the cathode, and the highest temperatures are positioned at the inlet of the two AS-IT-SOFC channels. The greatest heat production is that generated by the Ohmic source. The smallest heat production is that obtained by the concentration source, which is really negligible compared to the other sources. The heat produced by the electrochemical source is greater than that produced by the activation source.

For a gas inlet temperature of 883 K, the contributions of the Ohmic, activation, concentration and electrochemical heat sources in the evolution in the temperature values are respectively 80.604, 0.099, 2.296 and 17.001%. This proves that the heat source due to the Joule's effect is the most responsible for the heat generation inside the AS-IT-SOFC.

As a perspective of the present work, an optimization study of the AS-IT-SOFC overheating according to the operational and dimensional parameters will be envisaged for the minimization of the heat production inside the AS-IT-SOFCs, which logically will allow an improvement of the electrical production and lifetime of these fuel cells.

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