Supplementary Materials: A combined experimental-numerical investigation of the thermal efficiency of the vessel in domestic induction systems

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This document is intended to help the reader understand in more detail the research conducted.

1. THERMO-MECHANICAL ANALYSIS

In Figure S1 it is shown the displacements during the cooking of the steel plate due to its heating. It is represented with a deformation scale factor of 10.

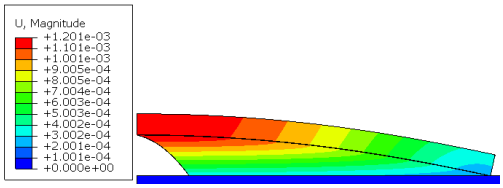


Figure S1. Profile of the steel plate modelled with the thermo-mechanical analysis. The magnitude are the displacements and it is measured in m.

2. DOE

Figure S2 represents the maximum, minimum and mean temperature in two models: one made of 100% steel and the other, 100% aluminium, during the whole cooking. At transient state, the difference between the highest and the minimum value at a time is higher than in the steady state: 52°C versus 19°C in case of steel and 17°C against 7°C in the aluminium scenario.

Figure S3a represents the main effects plot for the maximum sensor temperature. The maximum sensor temperature decreases as the conductivity gets higher. Specific heat, both convective coefficients and emissivity have nearly no influence. Lastly, when the pan is more concave, the maximum sensor temperature is higher because there are less losses. On the contrary, if the pan has less air between the base and the glass, the maximum sensor temperature is lower, see Fig. XXX of the manuscript. The main effects plot for the lost energy during the whole cooking is similar to the inserted energy, see Figure S3c. Figure S3b shows the main effects plot for the supplied energy in a cooking time of 400 s to observe if the specific heat has more influence in the output in a cooking of 400 s than in one of 1800 s.

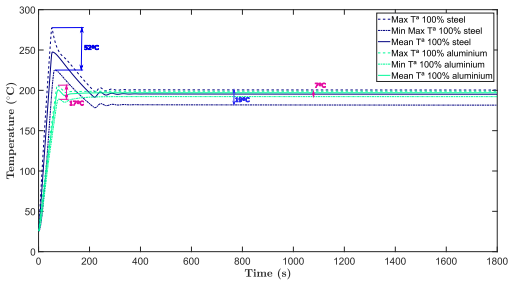
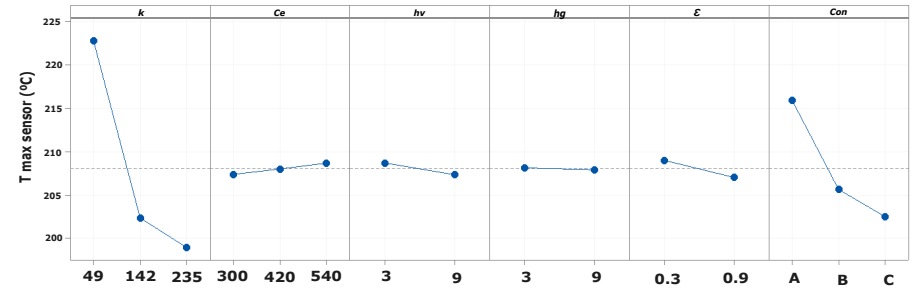
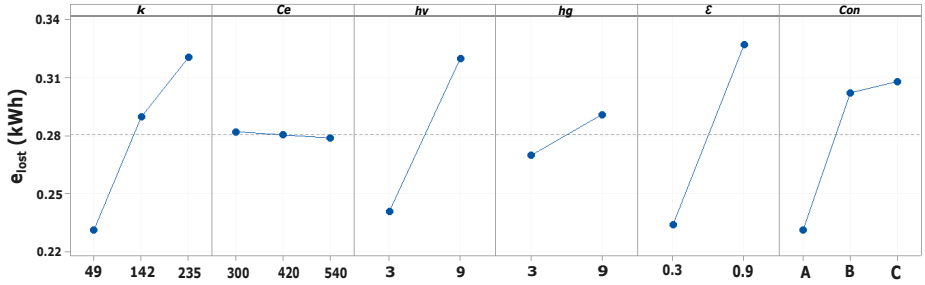


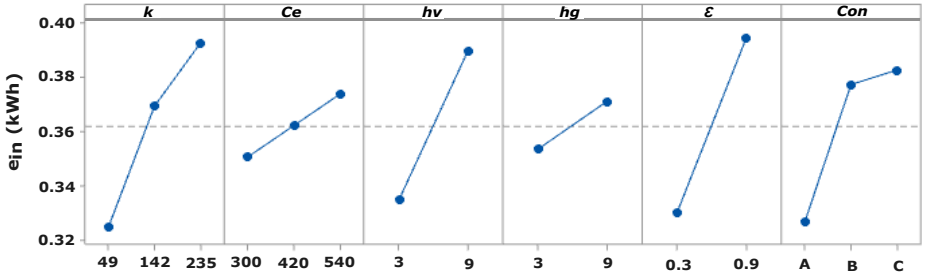
Figure S2. Maximum, minimum and mean temperature of a model made 100% of steel and another made 100% of aluminium along the whole cooking.



a)



b)



c)

Figure S3. Main effects plot of steel conductivity, steel specific heat, pan and glass convective coefficients, emissivity and concavity for the: (a) maximum sensor temperature, (b) supplied energy in a cooking time of 400 s and (c) total lost energy during the whole cooking. The units of the parameters are: conductivity (W/mK); specific heat (J/kgK); convective coefficients(W/m^2K); emissivity (-).

With the quality tool "Pareto analysis", the importance of the outputs that have been studied in DoE are shown in Figure S4.

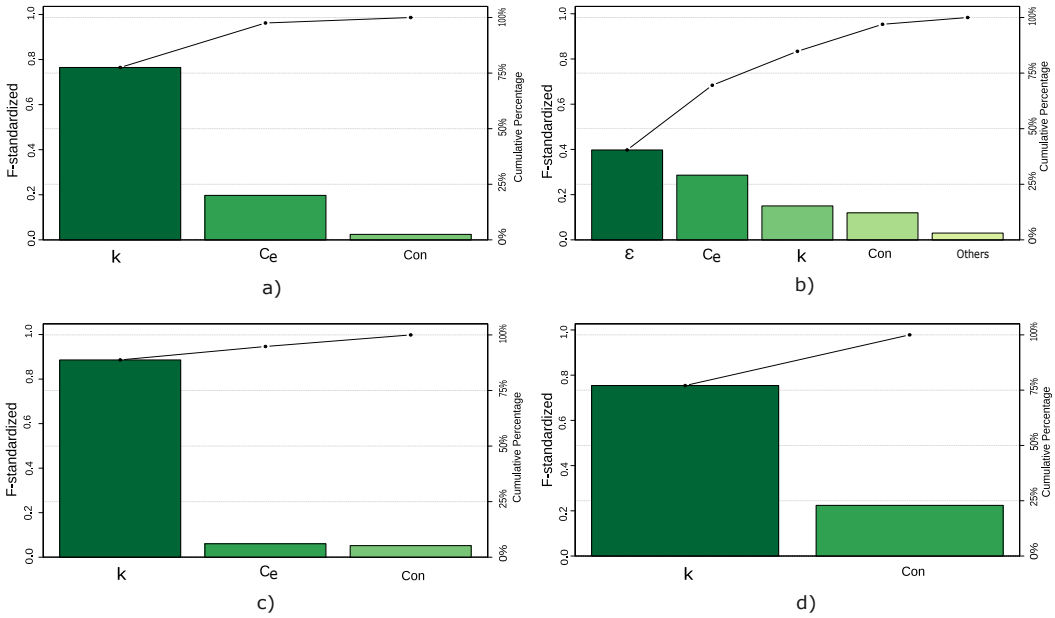


Figure S4

3. ENERGIES

Figure S5 shows the inbound and outbound energies of the Schulte pan and the steel plate.

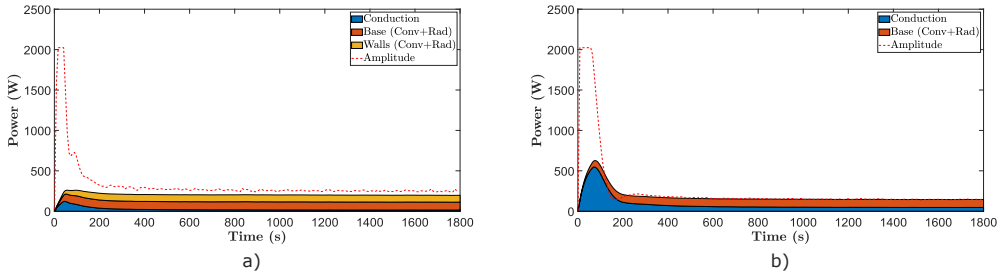


Figure S5. Representation of the losses of a computational simplify model of: (a) Schulte and (b) steel plate (coloured areas) and the amplitude of the power density introduced (red dotted line). Blue area corresponds to conduction losses between the base of the pan and the glass. Orange and yellow area indicate the convection and radiation losses in the base and in the walls of the pan respectively.