THE ANALYSIS OF THERMAL HOMOGENEITY IN THE FACILITY RANGE MICROWAVE RADIATING SLOTS

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Abstract
This paper proposes a field analysis of microwave heat radiating slot series device. The materials processing in microwave field is a technology developed and currently used in many applications.

Key words: microwave processing, radiating slot, electromagnetic field, dielectric permittivity.

INTRODUCTION

The materials processing in microwave field is a technology developed and currently used in many applications.

Due to the complex phenomena of interaction of microwave field in materials, is the success of these applications that requires knowledge of both material properties and in the design of processing equipment.

An important place is occupied by choosing the type of uniform distribution system and she has uniform electromagnetic field resonant type antenna applicators - radiating slot, which allows optimal operation of the power microwave generators, regardless of changes caused by the variation of dielectric constants.

MATERIALS AND METHODS

To analyzing the thermal homogeneity was used following the work bench:

Fig. 1 - Work bench

The work bench is composed by:

- The microwave oven
- plastic container for dielectric sample,
- wetted potato flakes
- Fiber optic device for measuring the temperature
- the microwave loss determining device for 2.45 GHz frequency
- electronic scales with precision
- humidity meter
- thermal room type “FLUKE TI 20”

For standardization and homogenization of field and the hence of the thermal field was used for a domestic oven which was introduce radiating slots series. In practice, the guidelines are used to produce a radiant field emulsion broad with perpendicular directed emission to the surface on the guide. In this purpose on the wide or narrow face surface of the guide slots must be cut more radiant systems. The question in this case is to establish the optimal distance between the cut slide on these guidelines and the normalized value of conductance and resistance on each slot.

The imposed conditions in this case are:

The amount of resistance induced by the slot and the normalized conductance must be equal to unity;

The preservation of characteristic impedance of the guide must be close with the stationary wave factor in wide frequency band. This condition implies adequate compensation reactance slots;

We must prevent the formation of side lobes radiating field slots for the optimize radiation in the perpendicular direction to the surface and to get a slot as higher earnings release.

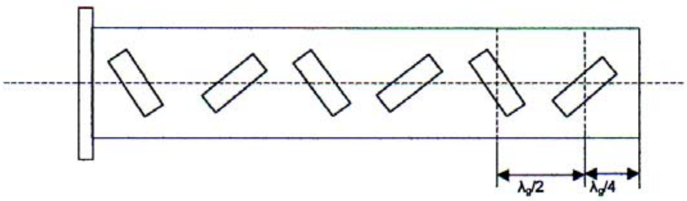

Fig. 2 - Position on the waveguide apertures

Thermal field analysis is being performed were homogenized and 100 g potato flakes with 600 ml water in a plastic container that was weighed with electronic scales accurate, then the composition was brought to power in a microwave variable processing time material is 5 minutes.

RESULTS AND DISCUSSION

For the first proof the microwave oven is set at 1200 W, the initial mass of material before being is added 724.85 g water and we adding water after the initial mass reached 775.9 g. Finally, after processing the final mass was 723.29 g. High-temperature zone is observed that migrates from the right to the left.

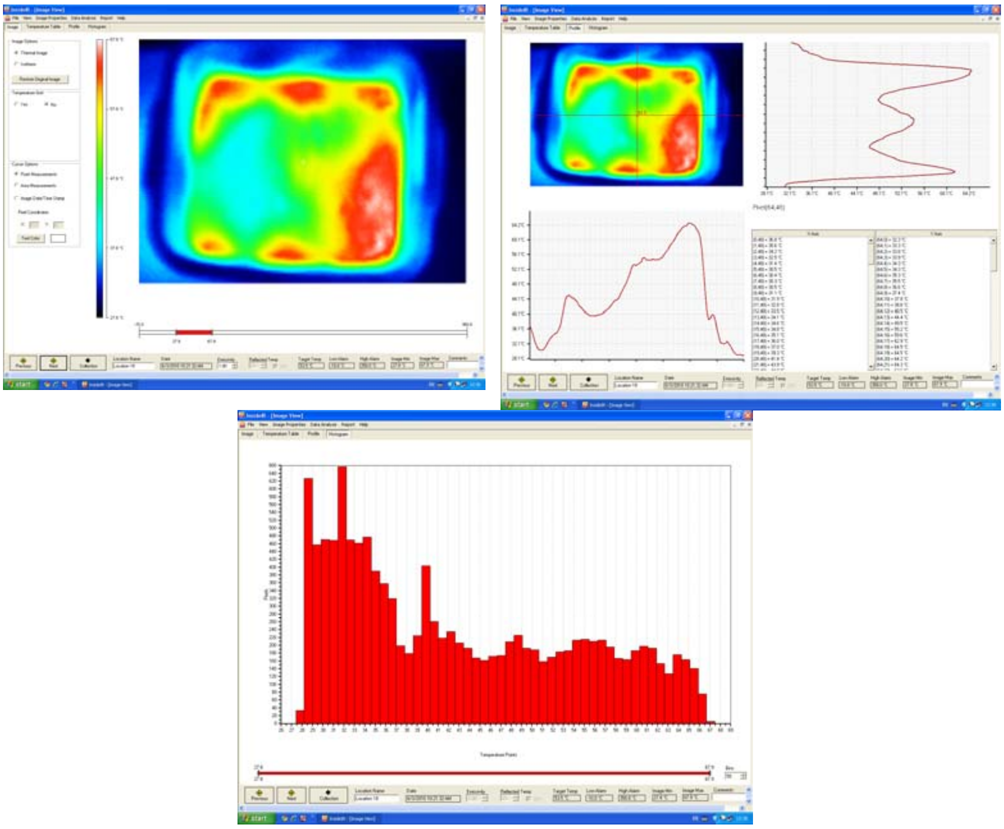

Fig. 3 – a) Thermal field b) Graphs of the thermal field, c) Diagram of the thermal field

At the second proof the microwave is set to 960 W, the initial mass of material before being is added 723.29 g water and we adding water and the initial mass is 760.94 g. In the final the mass was 726.6 g. The homogeneity is achieved in large part and is certifies the right radiant slots position.

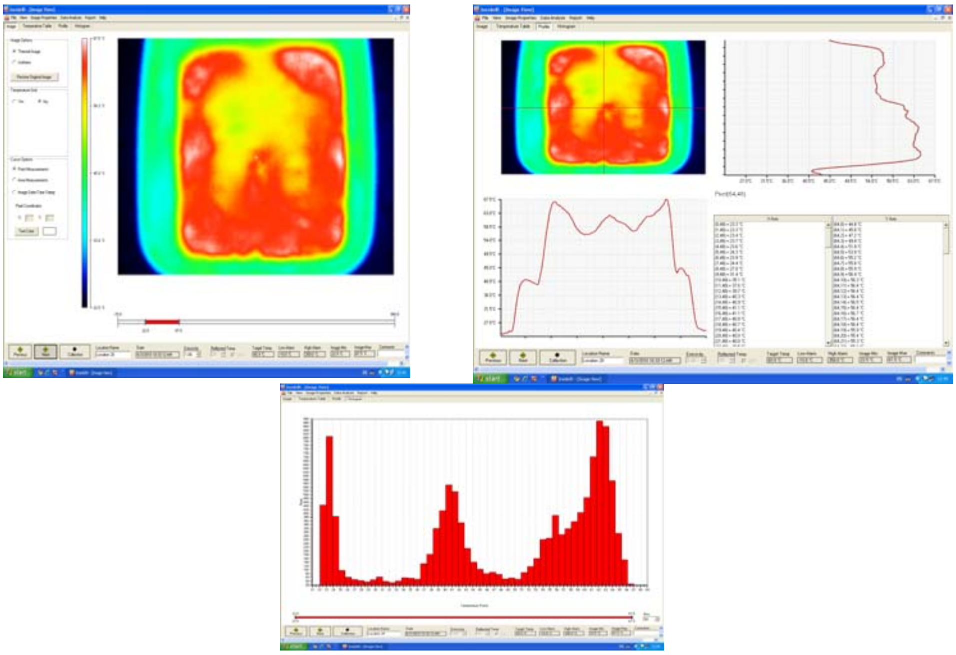

Fig. 4 – a) Thermal field b) Graphs of the thermal field, c) Diagram of the thermal field

In the third proof, the oven power is set to 720W. The initial mass of the material is 885.9 g, and after the process has reached final weight is 858.63 g.

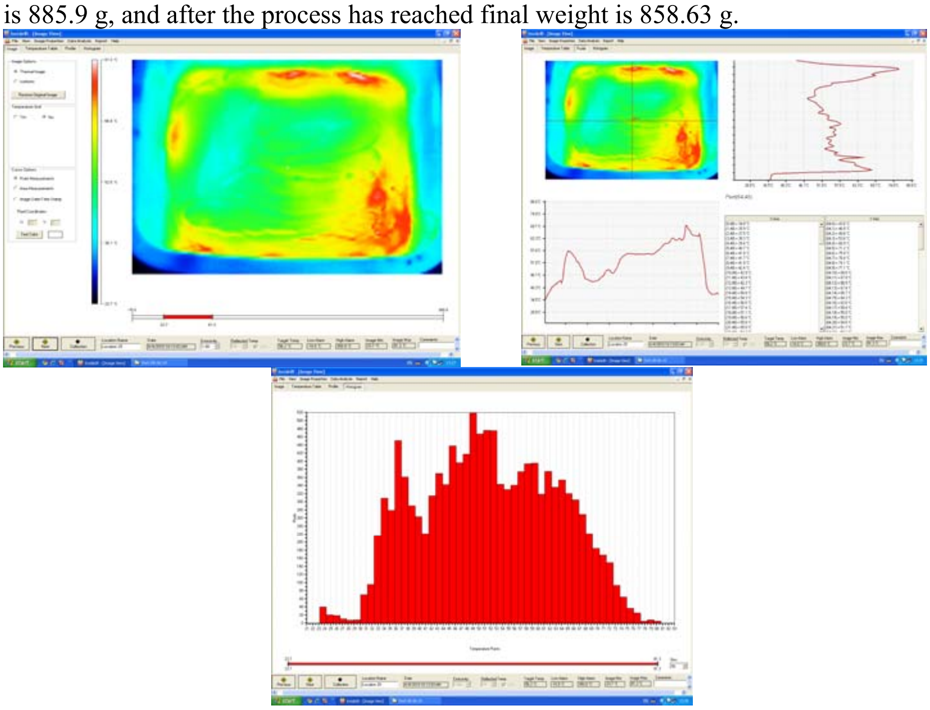

Fig. 5 – a) Thermal field b) Graphs of the thermal field, c) Diagram of the thermal field

The fourth proof the oven power is set to 480W. The initial mass of material before being added is 845.92 g water and adding water after the initial mass is 920.36 g. In the final we have 912.16 g.

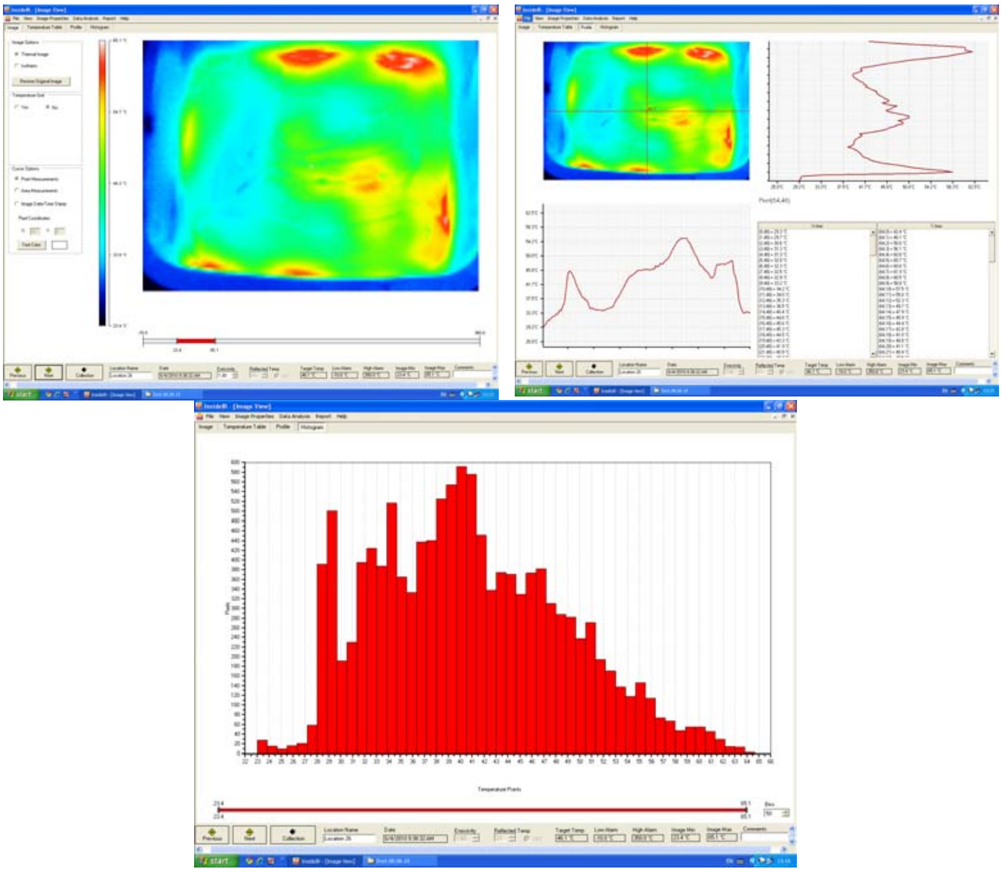

Fig. 6 – a) Thermal field b) Graphs of the thermal field, c) Diagram of the thermal field

In the fifth sample the oven is set at 240 W. The initial mass of the material being is 863.41 g, and after processing has reached a final weight 857.24 g.

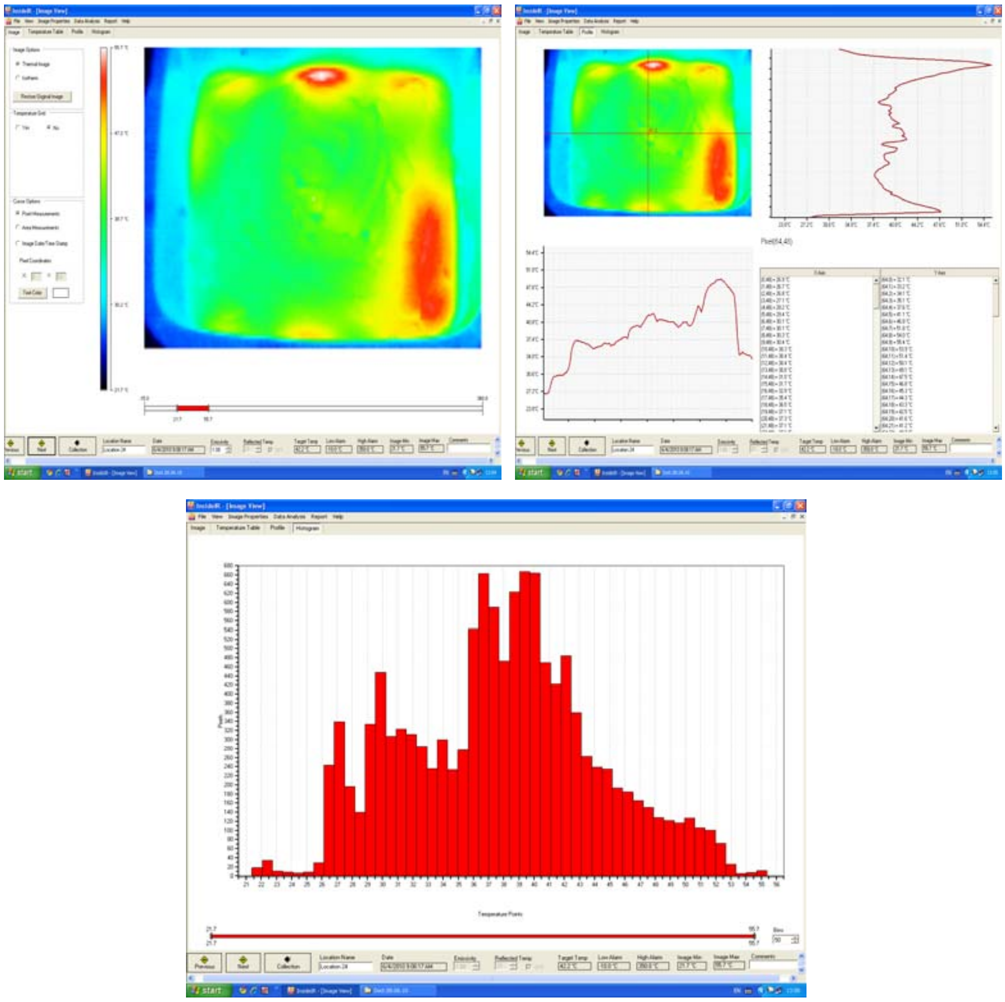

Fig. 7 – a) Thermal field b) Graphs of the thermal field, c) Diagram of the thermal field

CONCLUSIONS

After these determinations we concluded that the temperature is varies between 21.4^0 C and 87.7^0 C. The found evidence is in two and five sample where the uniformity of thermal field is homogeny. So in the sample two at the power of 960 W the temperature varied between 22.5^0 C and 67.5^0 C, with an average temperature of 60.9^0 C. In the sample five the power is 240 W, and the temperature ranging is between 21.7^0 C and 55.7^0 C and the average temperature was 42.2^0 C. The large temperature differences that appear in to the dielectric material show the contrary. The dielectric material is largely has a temperature of around 60.9^0 C (85%) respectively 42.2^0 C (79%). However, the uniformity may be improved, and what would the future research work. As a result, this radiation system and the coupled applicators are recommended to be used for uniform heating process without rotating turntable. In addition, these operating systems provide a suitable microwave generator, regardless of changes caused by changes in dielectric constant material (dielectric permittivity and loss factor) in our case of potato flakes humectants used in the experiment, with temperature during treatment.

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