The Electromagnetic Field absorber in microwave Owens

Diana Popovici* and Ovidiu Popovici**

* Department of Physics-Informatics-Chemistry
University of Oradea, Faculty of Environmental Protection,
26, Gen. Magheru st., 410048 Oradea, Romania, E-Mail: pdiana@uoradea.ro

** Department of Electrical Engineering,
University of Oradea, Faculty of Electrical Engineering and Information Technology,
1, Universitatii St., 410087 Oradea, Romania, E-Mail: popovici@uoradea.ro

* *

Abstract *– The heating process of the dielectric materials using microwave depends of the absorbing waves properties. In order to increase the temperature in the microwave owens, we can use a heat transformer made by a good absorber ceramic.*

Keywords: *heat transformer, high temperature, ceramic.*

I. INTRODUCTION

It is well know that the dielectric materials are absorbing the electromagnetic waves that generate heat inside them. The absorbing properties are describing by ε' and ε". When the material is heating in the microwave owen, ε', ε" are not the same, generally for ceramics, at low temperatures, till 200 – 400 ºC they are not very high. By consequence the rate of the increasing of the temperature is also low. We need more time to heat the ceramic and we spend more energy.

II. CONTENT

In order to reduce the heating time and to have an almost linear temperature curve we can use a cube made by a special ceramics with good absorbing properties and high ε', ε" all along the temperatures scale.

In the Fig. I it can be seen the heat transformer, 1 cm thin and 20 cm the side.

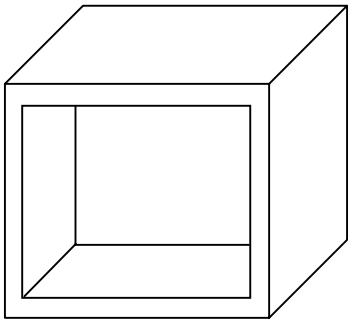

Fig. I. Heat transformer

The variations of the parameters ε', ε" of the special ceramics used for the heat transformer is presented in Fig.2

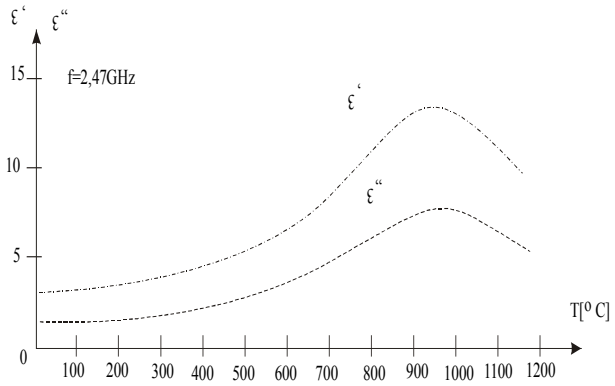

Fig. II. Variations of ε', ε" with the temperature

The heat transformer is placed in the microwave owen and the ceramic body inside him like in Fig. III.

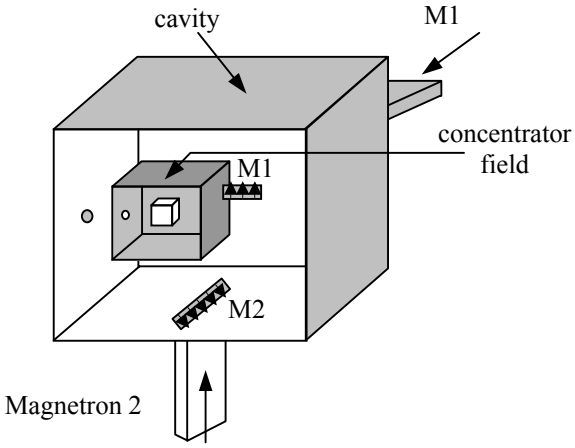

Fig. III. The microwave owen with heat transformer

The heat transformer is heating very rapidly and he is transferring the heat by radiation to the ceramic body. The outside part of the heat transformer cube is insolated very good, that we can theoretically approximate that all the heat is transferring to the interior of the cube.

In Fig. III, we can see the curves of the T=f(t) before using the heat transformer and after that.

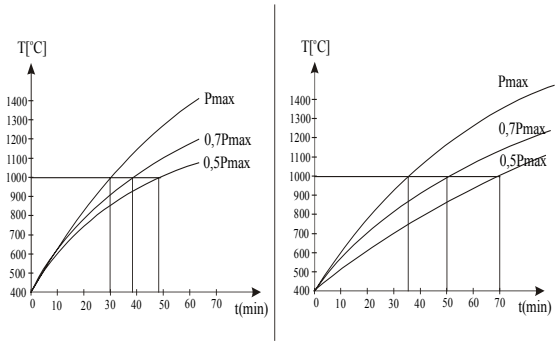

Fig. III. Variation of T=f(t) with and without heat transformer

The equipment used in the University of Oradea is presented in Fig. IV.

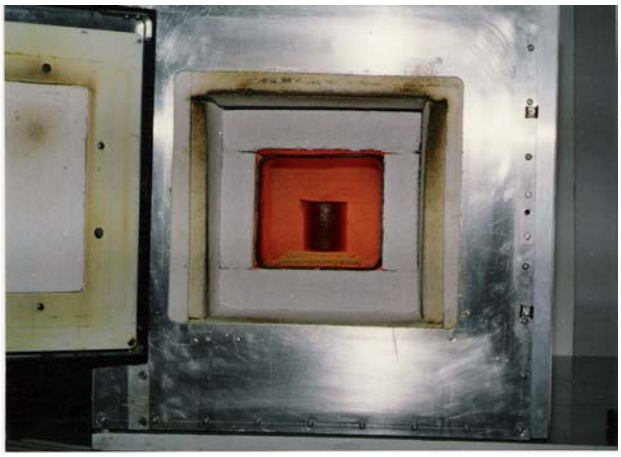

Fig. IV. Equipment for heating using microwaves

III. CONCLUSIONS

Using a good absorbing ceramic, like a heat transformer, is a good method to have shorter times to reach high temperatures and to improve the energetic balance of the microwave heating system.

REFERENCES

[1] O. Popovici, D.Popovici ,sa — The study in real time of the dielectric materials in a microwave energy field, Analele Universitatii Oradea,2007,Fascicola Electrotehnica, p115, ISSN-1223-2106

[2] D.Popovici, O. Popovici ,sa — The phenomena of burning and agglutination of ceramics, using the energy of the microwave to 2.45 GHz, Analele Universitatii Oradea 2007

Fascicola Electrotehnica, p117, ISSN-1223-2106

[3] G. Rulea — Tehnica microundelor. Ed. Didactică şi Pedagogică, Bucureşti, 1981

[4] G. Rulea — Tehnica frecvenţelor foarte înalte. Ed. Tehnică, Bucureşti, 1966

[5] J.S. Reed — Introduction to the Principles of Ceramic Processing. Ed. Wiley, N.Y., p. 355-572,1988