MOLDING PLASTER ELABORATION TECHNOLOGY USING THE MICROWAVE HEATING METHOD

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Abstract

The study of the phonic absorbant pannels to diminish the noise within ambiental interior environments has as a purpose noise absorption phenomena enhancing , through finding new recipes and compositions of phonic absorbent materials which should finalize by projecting and executing of several installations in order to determine the mechanical and resilient properties of these materials. In order to reduce the times to fabricate of the molding plaster, the growing productivity, the costs reducing price S.C Congips S.A Oradea has experienced, at the lab level, the use of the microwave energy to extract the crystallization water off the plaster rock. For the research and lab tests experienced at S.C Congips S.A. Oradea, for the plaster samples heating, a TIRMW63 microwave oven along with an air absorption installation out of the resonance cavity has been used.

Key words: phonic absorbent panels, noise, plaster, microwaves, oven, molding

INTRODUCTION

Microwaves are waving electro-magnetic radiations determined by the E- electric components and H magnetic ones pulsations of the electro magnetic wave in interdependence according to Maxwell ecuations.

The electromagnetic radiation called microwave is generated in voided electronic tubes named magnetron (Ungur, et al, 2010), out of which, through an antenna is extracted and then transmitted through a wave guide to the using area, in a cavity.

The radiation is produced through the cathode emitted electrons rapid deceleration mechanism into an electromagnetic field – *E* and *H* orthogonally disposed between the cathode and anode

The cathode emitted electrons in their trajectory flight towards the anode are releasing of their kinetic energy to the anode inside resonating cavities, out of which it is extracted through an antenna and from there further away through a microwave guide.

The H magnetic field acts upon the electrons inside the interaction space with a known Lorenz force, maintaining them on the trajectory as long as possible.

The dielectric materials are insulating organic or non organic materials (no electricity conducting properties), and the dielectric materials with losses are insulating materials with residual content of water molecules.

Hydrated plaster is such a material ($CaSO_4 \cdot 2\ H_2O$) already used for a long time in electrotechnology under the insulating shields.

As for the dielectric materials (Rufe, 2002), microwaves interact powerfully, eliminating, thus, the water out of the compositions.

The valuable fundamental physics relations when heating up a dielectric material with losses in microwave field, in our particular case – the plaster, is referred to the dielectric losses that occur in the water polarization process within an electromagnetic field.

The dielectric losses lead to the absorption of caloric energy, the dielectric heating up and to the losing of the crystallization water through vaporization.

MATERIAL AND METHOD

For the lab tests and research performed at S.C. Congips S.A. Oradea, it has been used a microwave oven (TIRMW63), completed with an air absorption installation out of the resonance cavity (hard vacuum).

In Figure 1 we present the installation used to create the molding plaster using a microwave oven.

Fig. 1. Microwave with H_2O vapor absorption plant

The electric field distribution (*E*) and the magnetic field distribution (*H*) inside the microwave oven parallelepipedal cavity is represented in figure 2 (Ungur P. A. et altri, 2009).

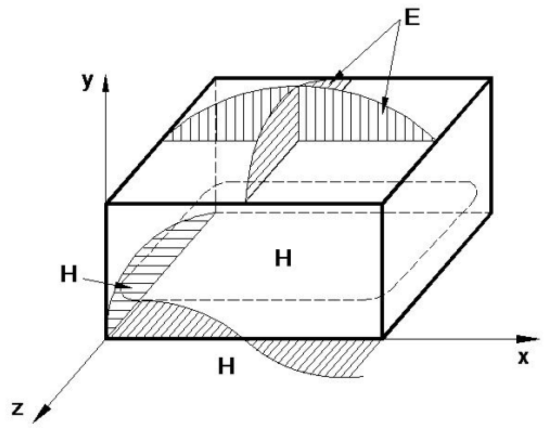


Fig. 2. Distribution of the electric field *E* and magnetic *H* into the cavity

In order to uniformly heat up the cavity there have been introduced plaster rocks with 5-20 mm granulation weight on an analytic scales. The used microwave oven has, as a platform a rotating tray. In figure 3 the microwave oven cavity is schematic rendered, cavity in which the plaster samples on a rotating tray is heated up (Ungur, et al, 2009).

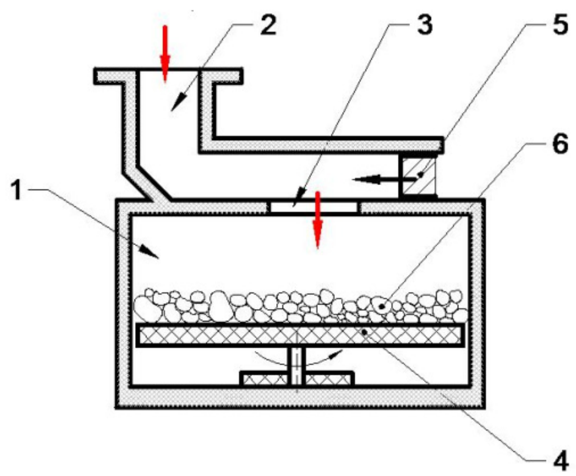


Fig. 3. Resonant cavity with air extractor for heating the gypsum pellets

When the resonant cavity is turned on, the microwave generator is to be insured protection. The cavity is connected to magnetron only when filled with dielectric material with losses ($CaSO_4 \cdot 2\ H_2O$).

The temperature in the oven reached 200-300 degrees Celsius in a very short notice.

The dehydration time leveled to 30 minutes.

In Fig.4 the thermic treatment diagram is rendered.

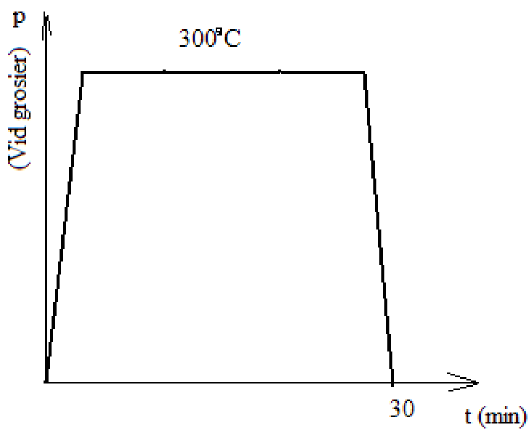


Fig. 4. Diagram of the thermal treatment for gypsum in the microwave field

At the end of the cycle the inside water vapor suction installation wast turned on. The plaster quantity was 200 grams. After the dehydration, the plaster thus obtained underwent a stabilizing treatment in a sink for a few days, where it was grinded and tried for re-hydration. In Fig 5 is represented the picture of plaster granulation and of the obtained plaster powder (Ungur, et al, 2009)

Fig. 5. Samples of gypsum and plaster result

In figure 6 there are represented both a hydrate and a dry plaster sample on a glass tray, while in Figure 7 their fractography.

Fig. 6. Sample of plaster hydrated

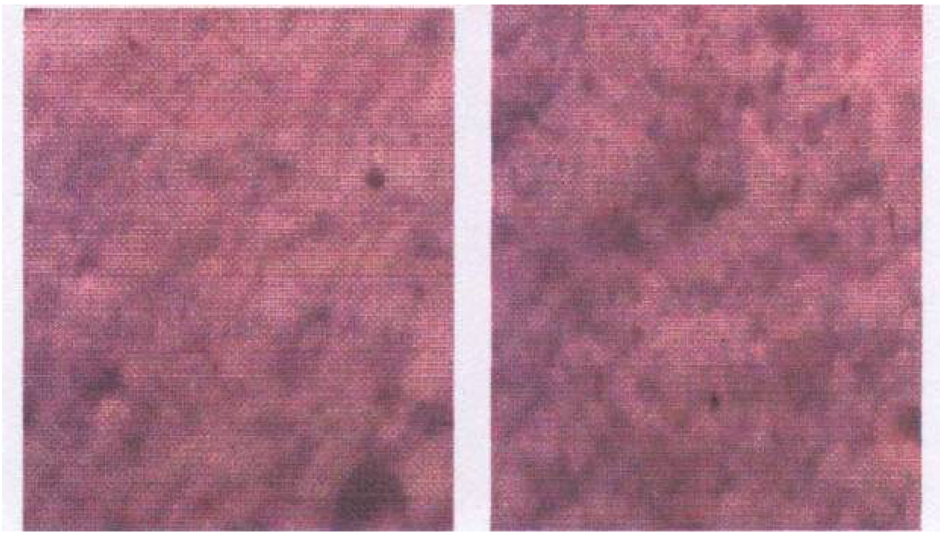
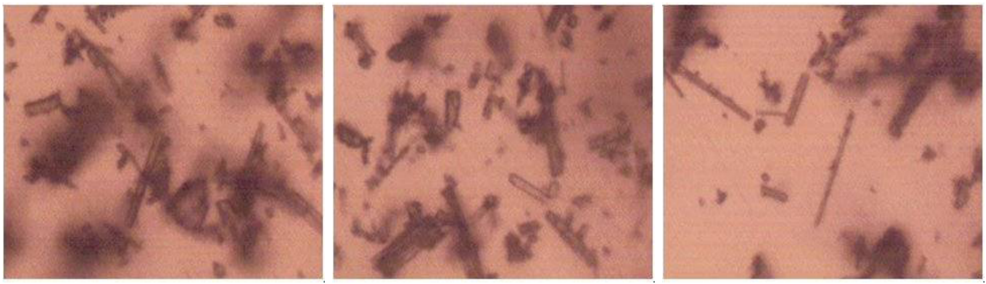


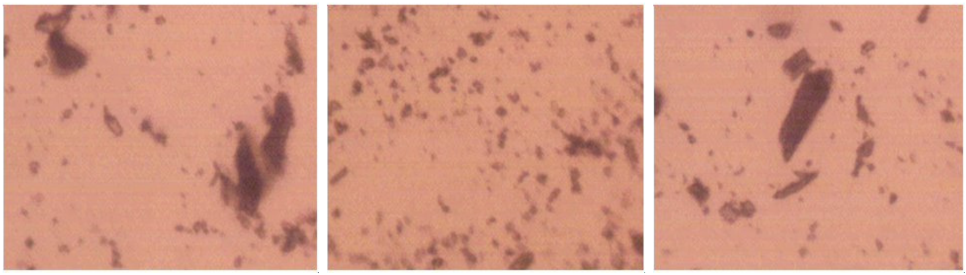
Fig. 7. Fractography of thr proof of plaster hydrated scale 60: 1

In Figure 8 a,b,c the plaster microscopic structure, obtained in a microwave field is rendered and compared with the molding plaster structure α and building plaster β (Ungur, et al 2009).

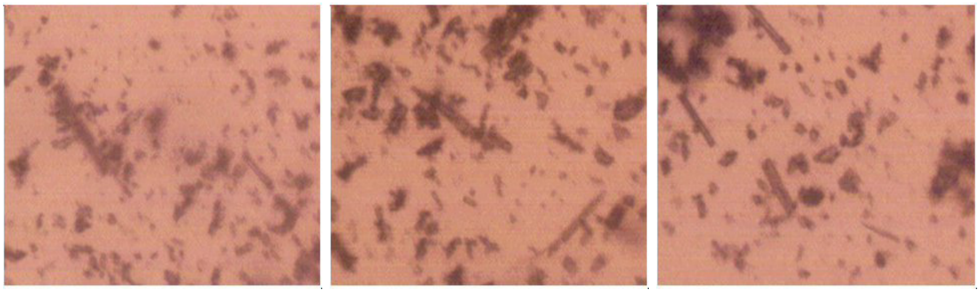
A resemblance between the samples b and c is to be noticed, which leads us to the conclusion the plaster obtained inside the microwave field, at 200-300 degrees Celsius and in conditions of normal environmental pressure is a variant for the plaster.



a: α- plaster modeling



b: β- plaster construction



c: plaster

Fig. 8. Microscopic structures of plaster samples: of α-plaster; b-c β, plaster-plaster m

In order to find other important properties an enhanced material quantity is required and that can only be obtained in larger ovens or pilot stations.

CONCLUSIONS

In this work were presented new methods to obtain the molding plaster, new construction materials trial conditions, as well as new molding recipes to lead to improving the quality of the new material.

By the results obtained following the lab tests and trials, executed at S.C. Congip S.A. Oradea, in order to obtain the molding β plaster out of plaster ore inside the microwave field it has been demonstrated that plaster ($CaSO_4 \cdot 2\ H_2O$) is a dielectric material with losses.

Through uniform heating up of the plaster granulation of a specified depth dimension, through microwave energy, the plaster obtaining process for molding can be done at normal pressure conditions, in a very quick notice which can lead to an enhanced productivity and a lower cost.

By modifying the specific parametres of the elaboration process of the plaster through microwave energy, temperature, pressure, time molding plaster alpha is easily attainable.

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