THE PHONIC ABSORBENT PANELS DESIGN AND TECHNOLOGY

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Abstract

A great deal of care is given to the interior ambient in civil and industrial buildings, by using diverse molding plaster basic compositions. The compositions and the composed materials are similar to composed materials, the only difference residing in the functioning temperature and the functions it has to fulfill. The compositions are basically different construction materials with new properties. The study of phonic absorbent panels for the interior ambient noise diminishing has as a goal the noise absorption improvement by finding new compositions and recipes for the phonic absorbent materials in order to take shape by projecting and executing new installations to determine the mechanical and resilient properties of these materials. The research and lab tests are performed to obtaining new materials with new phonic absorbent properties.

Key words: phonic absorbent panels, noise, plaster, network, matrix

INTRODUCTION

The research and lab tests have been conducted at S.C. Congips S.A. Oradea inside the plant laboratory. They were performed in order to create new materials with enhanced phonic absorbent properties. Two recipes have been projected and lab specific characteristics have been conducted.

In a first reading the recipe is made up of: 35-40% **α** molding plaster, 2,5% calcite, 3,5% dehydrated lime, 5,8% white cement, 1,5%-2,5% expanded styrofoam with a density in between 12-15 kg/cubic meter, sliced in between 0,7-1mm over 30% and 0,5% retarding admixture, 3-5,5% diverse powder oxides as color and 36-44% water, the percentage expressed in weight.

The M.O. (modus operandi) was the following: a mixture has been constituted out of 35 kg **α** molding plaster, 6,06kg white cement, 1,9kg polystyrene granules with a density in between 12-15kg/m^3 with the granules width in between 1,65 and 2,1 mm, 0,7 tartaric acid, retarding admixture, 3,9 kg natural powder oxides and 34-35% water, all put inside the mixing tank and mixed for 15 minutes. Then, later on, the obtained concoction has been treated with 43-55% kg water forming up a casting slip, which was poured in standard metal form. After 30 minutes the trial pieces have been unmolded and tried mechanically for 24 hours and for 7 days.

In a second reading (variant) instead expanded polystyrene we used perlite (pearl stone). In specific literature (Hancu, et al, 2003) the expanded perlite is very porous, with a very low density, natural sound and vibrations absorbent (Brindeu, 2001) in this second reading we started from a recipe made up out of 35-40% α molding plaster , 5-8% white cement, 3-7% expanded perlite powder with a density between 10-10,34 kg/m^3, with the powder granules width between 0,13-0,15 mm in 1%, with a griddle rest of 0,125 mm, 0,66+0,120mm 21%, griddle rest of 0,065mm 78%, 0,51% tartaric acid as retarding admixture of 0,7 kg, 3,9 kg natural powder oxides as coloring agent which uniformed inside mixing tank installation in a dry state, after which it was treated with 42-51,5% kg water versus total dry mass and mixed up in a common lab kneading machine forming a casting slip, which was poured in metal forms for the standard samples.

The experiments continued with different recipes using the **α** molding plaster and β molding plaster, with an adding of pearl stone and acceleration additives. The methods to try different obtained compositions have as a basis the SREN standards 13279-2/2005 and SREN 13279-1/2005 in similarity with European standards, `Plaster and plaster based products` (SREN 13273-1,2005)

MATERIAL AND METHOD

Trial conditions:

The trial conditions and the sampling ones have been realized in the plant laboratory of SC Congips SA Oradea. According to the current norms regarding the trial of the construction materials respectively of those of plaster basis are comprising the following trial steps (SR EN 13273-1,2005)

The trial atmosphere:

- room temperature (23± 2)˚C
- humidity.

Sampling:

- sampling has been conducted according EN 196-7 and EN 932-1

preparing the sample

The representative sample had (50 ± 5) g with a reduced granulation up to 0,1mm.

Water: The water used for the basic trials and chemical analyses was distilled water. Instruments and devices: the devices used as well as the used patterns to prepare the tensiles must be executed out of water proof materials and which do not react with the calcium (lime) sulphate as following: glass, yellow copper, stainless steel, ebony or rigid plastic materials.

The granulometric analysis: the devices used contains the control after-filtration according to ISO 565. To determine the granulation another wooden palette knife is used, a scale with ± 0,1 g precision and a humidifier. The M.O. consists of passing the grinded/milled plaster sample, 500g ± 5% through the vibrating filters of the device, thus establishing the mass remained on the filters out of the total mass of the sample. The medium between the two obtained results is to be considered and then noted]n the trial report.

Establishing the ratio water/plaster: water/plaster ratio is determined through several methods:

a. Dispersion method

In that case the plaster consistency is fluid, and the method consists in measuring the flow of a pasta hold inside a pattern when the pattern is removed. By this method the plaster mass destined to a procedure of a particular pasta consistency is established. The necessary devices come as follow: a mixing vessel, a wooden palette knife, Vicat ring with a 40mm height with the superior interior diameter of 65mm and the inferior interior diameter of 75mm, flat glass panel, timer, beam compass, and a line standard.

b. Spreading mass method

Through that method the water /plaster ratio is established, the plaster uniformed to a given consistency. The consistency establishing is made by measuring the diameter after its spreading to a diameter up to 165± 5mm. The equipment used comes as follows: mixing device, mixing vessel, palette, spreading mass and Vicat cone, beam compass, line standard, timer.

Establishing the hardening time:

a. Knife method

The method principle consists in that that the hardening time is measured in minutes, after which the cutting margins made in cross section on the plaster pasta with a knife, stops closing in.

The apparatus used is: knife with a 100mm blade in length, 16 mm width and a thickness of 1mm at the upper edge level having a feather shaped straight section; a palette, a smooth plate, timer, mixing vessel non-reactive material. The time for the grip beginning is to be established.

b. Vicat cone method.

This method is valid for all pre- uniformed plasters containing additives and retarding admixtures. The principle of this method has at the basis the protrusion depth of the Vicat cone into a paste made up of water and plaster, which gradually diminishes the more the grip progresses. This principle is used for the establishing of the grip or hardening beginning. The

apparatus used is> Vicat device, conic penetrator, glass panel, Vicat ring, 14mm line standard, timer, mixing device and palette.

Establishing the mechanical properties.

In order to establish the mechanical properties we use the hardness trial methods to bending and compression, known from the concrete mechanical properties establishing. In 3.15 figure the bending tried apparatus is presented. With the help of this apparatus we determine the required force for breaking of a plaster prism with 160mm x 40mm x 40mm leaned against two rollers with a 100mm distance in between.

Other mechanical trials forseen in SERN 13279-2, 2005 are establishing adherence. Determining adherence has as basis measuring plaster adherence to a particular support, as being the maximum sustained weight, if a metal disc fixed on the plaster is submitted to a bending force.

To determine adherence a traction device is used to allow inflicting a traction force on the metal plate/disc, without the entire ensemble be submitted to a bending force. Out of the trials methods gathered in SERN 13279-2, 2005, regarding plaster and plaster based compositions, these are applied entirely in plaster plants, having in sight to both the basic matter, binding agents gypsum based, ceiling elements including less other specified methods for specific determinations for special use plasters.

Thus, in SR EN 13279-1 2005 and SR EN 13279-2 2005, as well as in the European standards EN 13279-2 2004 and EN 13279-1 2005 there are not scheduled methods for phonic-absorbent plaster and plaster compositions specific trials which are not included even in the standards that gp to cement trials. The accoustic performances can be determined according to European standards En ISO 140-3 and EN ISO 717-1, and the absorbent properties are established according to the European standard EN ISO 354. Two new modern installations to establish the elastic and phonic-absorbent properties of the construction materials are presented in this work.

RESULTS AND DISCUSSION

The experimental research on phonic-absorbent molding plaster based materials continued at SC Dosestilos SRL Oradea, where new recipes have been tested and new phonic absorbent panels were molded (Ungur P.A et al, 2010).

The installation used for molding plaster based panels casting is Mixing machine `Siemens` COROS OP5 (fig 1), which can control automatically the casting process.

Fig. 1 Mixer 'Siemens' CARPENTER OP5

The recipe used for phonic absorbent molding plaster based panels was as follows: water (6 l) + plaster (95%) +perlite (5%) the mix contains approx 3.5 kg, and for composition hardening we used as matrix a glass fiber armor with e length betwee 3-3.5cm.

Fig. 2. Fiberglass armor

Fig. 3. The mixture composition

The matrix is cleaned with silicon (striking), then the device vibration follows in order to set itself as good as posiible the composition into the matrix.tha casting matrix has the following dimensions: 597X597 mm.

Fig. 4. Mold casting

Fig. 5. FB design

Once the casting matrix ready the casting process begins. Thus, the composition mix is cast in the matrix and then follows its vibration for a uniform setting of the composition inside the matrix.

Fig. 6. The sound-absorbing panel in the mold

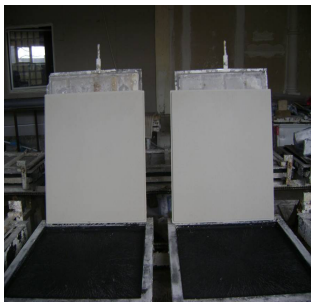

Fig. 7. Matrix and removing the sound absorbing panel

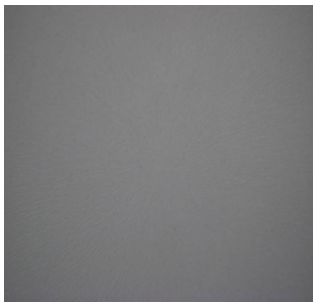

Fig. 8. New sound-absorbing panel

The drying is made progresively at 600^{o}C with a dryer, or in a natural way for 3-4 days. In our case we chose the natural drying.

CONCLUSIONS

In this work have been presented the experimental research for obtaining new compositions alpha plaster based compositions with phonic-absorbent properties. With `Dosestilos` and SC Congips Oradea, in colaboration with University of Oradea and Technical University Cluj Napoca the casting and execution technology of the phonic-absorbent panels out of molding plaster has been elaborated.

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