



INFLUENCE OF MOLDING METHOD ON PRODUCTS MADE OF MAGNESIA BINDER

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Abstract:

This paper presents effect vibrovacuumizing (vibration+vacuum) on the strength of magnesia binder. The specimens were prepared at the water-cement ratio of 0.8 and they were tested at 1, 3, 7 days of curing. Some interesting results were obtained from the test of different method forming.

Keywords: Caustic Magnesite; Vibrovacuumizing; Vibration; Compression; Molding.

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1. Introduction

Magnesia or magnesium oxide is an alkaline earth metal oxide. The majority of magnesium oxide produced today is obtained from the calcination of naturally occurring minerals, magnesite, $MgCO_3$, being the most common. Other important sources of magnesium oxide are seawater, underground deposits of brine and deep salt beds from which magnesium hydroxide [$Mg(OH)_2$] is processed. Magnesium is the eighth most abundant element constituting about two per cent of the earth's crust and typically 0.12% of seawater. Both $MgCO_3$ and $Mg(OH)_2$ are converted to MgO by calcinations [1]. The thermal treatment of the calcination process affects the surface area and pore size and hence the reactivity of magnesium oxide formed. The source largely determines the level and nature of impurities present in the calcined material. Caustic calcined magnesia which is used in a wide range of industrial applications e.g. plastics, rubber, adhesives and acid neutralisation is formed by calcining in the range 700–1000°C. By calcining in the range 1000–1500°C the magnesium oxide is used where its lower chemical activity is required e.g. fertilizer and animal feed. Dead-burned magnesia, which is produced in shaft and rotary kilns at temperatures over 1500°C, has reduced chemical reactivity therefore is more suited to refractory applications. Finally, fused magnesia which is produced in an electric arc furnace from caustic calcined magnesia at temperatures in excess of 2650°C is used for a variety of refractory and electrical applications [2].

The aim of the present work is to characterize the effect vibrovacuumizing on strength of magnesia binder.

As early as in the 30s of the previous century vacuum compaction of concrete mixes has been used successfully in the construction of buildings and structures of mass concrete [3, 4, 5]. In practice, back at that time the advantages of vacuum compaction of concrete mixes in monolithic structures had already been convincingly proved. The main ones are the following: increase in labor productivity; reduction of the period of construction of buildings or individual structures; significant reduction in metal consumption (material consumption) by formwork; energy savings; reduction of specific consumption of cement; significant improvement in concrete quality. The technology vibrovacuumizing, which provides the appearance of the positive properties of concrete as the rapid growth of strength in the initial period of hardening, reduction of time for the heat treatment of products, reduction of metal processing equipment by reducing the fleet forms and reduce W/C vibrovacuumizing technology significantly increases the degree of compaction of the concrete mix [6].

2. Materials and Methods

In the Kharkiv National University Civil Engineering and Architecture carried out a study on the use of a magnesia binder for manufacturing specimens. There were two types specimens were prepared two specimens were casting by vibration and two specimens by vibrovacuumizing. Specimens details 20×60×40 cm with hollow section 17×57×40, humidity of the mixture (W/C) was used in the range of 0.8. The apparatus of test samples is shown in figure 1.



Figure 1: Laboratory equipment for sample preparation by method vibrovacuumizing

Binder- Caustic magnesite Lebanon with a bulk density equal to 865 kg/m^3 , the brand of caustic magnesite PMK-87;

- Magnesium chloride $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ – to increase the solubility of MgO , and its interaction with the water velocity.

Table 1: Content of caustic magnesite

MgO	SiO ₂	CaO	Al ₂ O ₃	Fe ₂ O ₃ + FeO	Na ₂ O + K ₂ O
84,4	2,7	3,3	0,9	1,6	1,7

For hydration magnesia binder used aqueous MgCl₂ solution with a density 1,125-1.220 g/cm³.

3. Results and Discussions

It was investigated vibrovacuumizing effect on the specimens shown in table 2, the vibrovacuumizing reduces the permeability of magnesium oxide cement mortar, which is characterized by a decrease in the water absorption of the magnesium oxide cement mortar [6]. By reducing the number of pores in the cement mortar when the water is released, the magnesium binder strength will increase. The degree of compaction of the magnesium oxide cement mix at vibrovacuumizing depends on the frequency and amplitude of the vibrator and the duration of vibration and vacuum. When compacting magnesium oxide cement mixes oscillation amplitude was within the range of 0.3-0.7 mm at a frequency of about 3000 vibrations per minute [6]. Owing to the depression created in the suction shield of the mortar through the filter sucked air and water which are removed with a vacuum pump. Cement particles retained by special filter materials.

Table 2: Physical and mechanical properties of compositions

Casting type	Compositions	Quantity	Time by day	Ultimate Compression force in Ton
vibrovacuumizing	- Caustic magnesite, brand PMK-87 - MgCl ₂ .6H ₂ O - Water	7000 g, 30% from PMK, 50% from PMK	1	81
vibrovacuumizing	- Caustic magnesite, brand PMK-87 - MgCl ₂ .6H ₂ O - Water	7000 g, 25% from PMK, 50% from PMK	7	98
vibration	- Caustic magnesite, brand PMK-87 - MgCl ₂ .6H ₂ O - Water	7035 g, 30% from PMK, 50% from PMK	1	55
vibration	- Caustic magnesite, brand PMK-87 - MgCl ₂ .6H ₂ O - Water	7035 g, 30% from PMK, 50% from PMK	7	64

The experiment shows that the specimens were casting by vibration owned load curve refers to the existence of small improvement in the compression.

In case of the concrete specimens were casting by vibrovacuumizing refers to the existence of significant improvement in the compression load compared with vibration specimens see fig. 2.

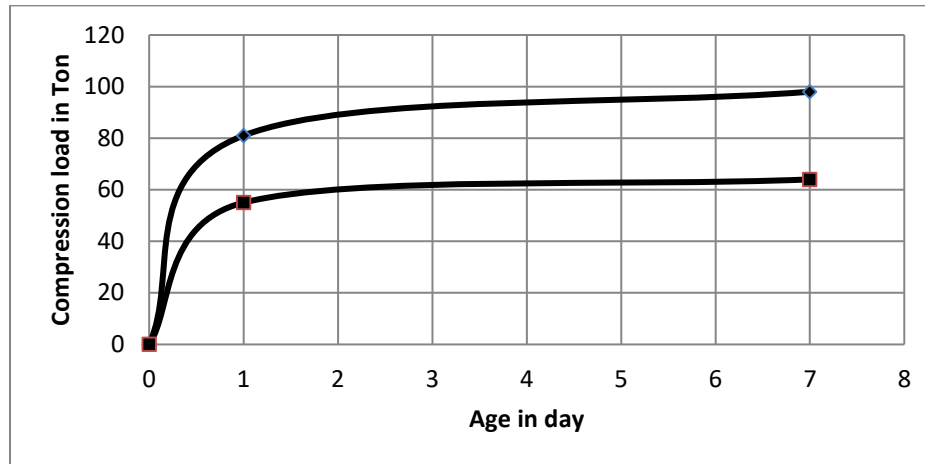


Figure 3: Compression strength of the magnesite binder specimens:

- 1) specimens were casting by vibrovacuumizing;
- 2) specimens were casting by vibration.

4. Conclusion

The magnesite binder specimens were casting by vibrovacuumizing showed higher strength in comparison to the concrete specimens were casting by vibration. The experiment demonstrates that the magnesite binder specimens were casting by vibration has voides and pores, and therefore, these voides and pores decrease of the mechanical properties of the specimens, but when casting by vibrovacuumizing, the voides and part from water decreased and therefore the mechanical properties of the specimens improved.

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