Characteristics of a mortar with diatomite as replacement of sand : Heat insulation potentiality

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Introduction

- Since 1992, the Energy Laboratory of the Faculty of Sciences of Tetuan (Morocco) focuses on the thermal and mechanical characterization of local building materials; that is in the aim of the research of new materials, which can satisfy the builders needs: good thermal insulation, acceptable mechanical strength and low cost.
- The integration of lightweight aggregates in a process of manufacturing concretes could, on the one hand, satisfy these needs and, on the other hand, constitute an important way for valorizing these aggregates. The principal objective herein of the incorporation of diatomite in a mortar as replacement of sand is to improve the heat insulation performance of the mortar while preserving its bearing.

Composites Formulation

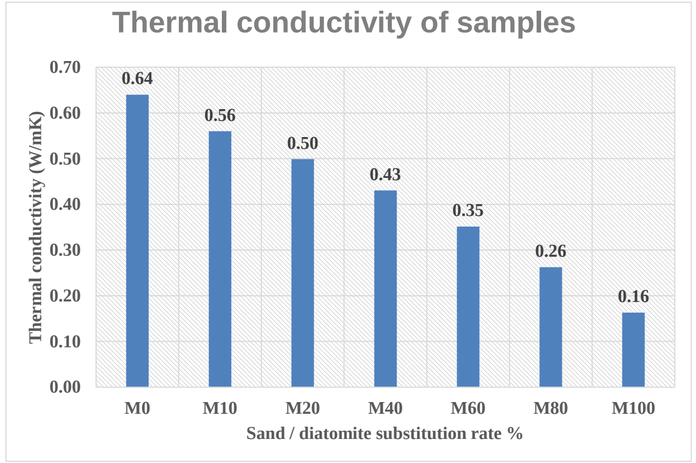
- The diatomite aggregate used is from the area of Nador-Morroco (Fig. 1), obtained after grinding the material in a BB10 grinding machine. BB10 type is designed for crushing and grinding a few kilograms of samples. In a previous study, we have shown that the studied diatomite has a good quality and can be used as a building material [1].
- The sand used is a CEN standardized commercial one. It is a natural sand, siliceous in particular in its finest fractions. It is clean, dry, and the particles have generally isometric and rounded form.
- The cement used in this study is a compound Portland cement CPJ 35. It has mechanical performance and physicochemical characteristics in accordance with Moroccan standard NM 10.1.004 [2].
- The reference mortar is in accordance with the standard NM 10.1.005 [3]. It is based on 1/4 of the cement (C) and 3/4 of the sand (S) with a water cement ratio (W/C) of 0.5. For the other formulations, the sand is substituted by diatomite (D) at D/(S+D) mass contents ranging from 10 to 100%. The (W/C) is between 0.5 and 0.7. Except the reference mortar, it is found that the amount of water is insufficient to maintain acceptable workability. To overcome this problem an adjuvant was added. A water reducing plasticizer compatible with the standard NF EN 934-2 [4] was used.

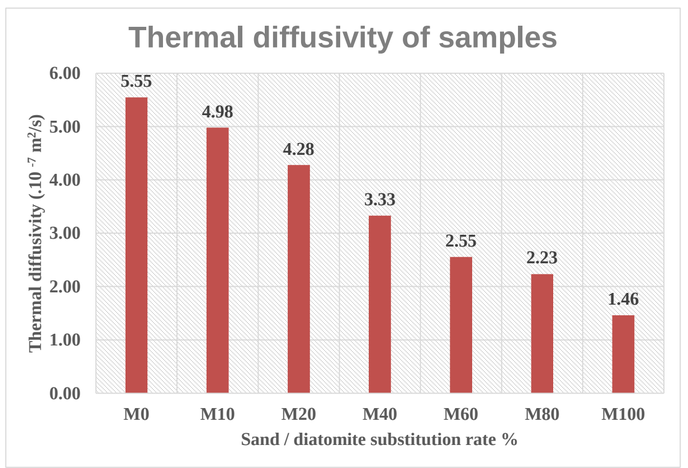
Fig. 1: Used diatomite

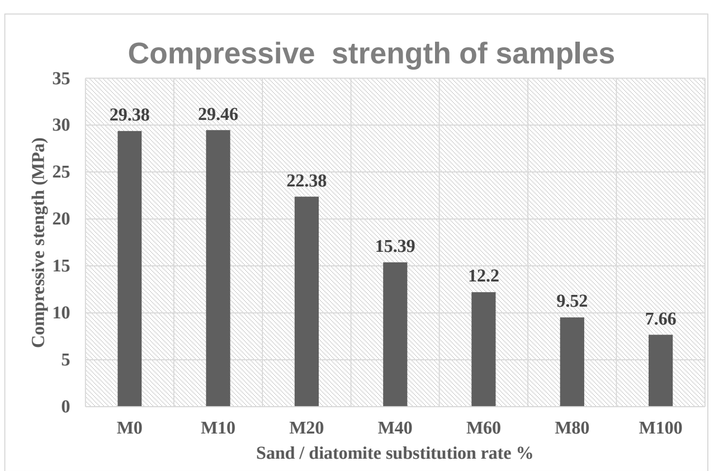
Methods

Physical characteristic	Thermal Conductivity	Thermal Diffusivity	Compressive strength
Method	Model house-box [1,5]	Flash Method [1,5]	Standard NF EN 196-1 [6]

Results







Results Discussion & Conclusion

- The thermal conductivity and diffusivity decrease with the addition of diatomite in the mortar and consequently the thermal insulation potential is improved. For a mass percentage of diatomite ranging from 0 to 100%, the reduction in thermal conductivity increases until 75.38% and the reduction in corresponding thermal diffusivity increases until 73.69%.
- The obtained values of thermal properties make this composite a competitive material with lightweight insulation concrete.
- The mechanical strength was noticeably reduced as the replacement level was increased. For a mass percentage of diatomite ranging from 0 to 100%, the reduction in compressive strength is about 73.93%
- In spite of the reduction of compressive strength with the addition of diatomite, the results obtained are satisfactory to use this type of mortar as insulating concrete (RILEM) [7].]. It would therefore be possible to use this material to build walls or floors for example.

References

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