

## A study on recycled gypsum and Portland cement- based binders

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### Abstract

Gypsum-cement blends are not so common because produce expansive reactions, which can produce cracking and spalling. A previous experience indicated the possibility of this blend, without expansion, increasing the durability of the final product. In this meaning, this study evaluated the properties of this blend, using recycled gypsum. Mixtures of recycled gypsum and cement were evaluated in both fresh and hardened states aimed at comparing its physical, chemical and mechanical properties in relation to the commercial gypsum, previously used. Results show that the blend can be used, and that this new material did not suffer expansions, inducing a durable material in moist environments.

*Key words: recycled gypsum, Portland cement, binders.*

### Introduction

The gypsum is a binder with fast curing. Despite having a good performance, attractive appearance and easy application, its use is limited to indoors due to its solubility. The Portland cement is a binder with slower cure and stands up well in permanent contact with water.

The blastfurnace slag Portland cement has in its constitution high levels of slag, providing materials that are more durable.

The gypsum-cement blends are not appreciated due to delayed ettringite formation. However, this type of cement already showed positive results when mixed with commercial gypsum<sup>1</sup>.

The purpose of this study is to analyze the properties in both fresh and hardened states of the recycled gypsum<sup>2</sup>-cement blends aimed at increasing the durability.

### Results and Discussion

Experimental mixtures, cement-gypsum pastes: M1 (100-0), M2 (75-25), M3 (50-50), M4 (25-75) e M5 (0-100). Curing conditions: protected environment and exposed to the environmental conditions (sun and rain). Properties valued in the fresh state: setting time, consistency and kinetic temperature; in the hardened state: flexural and compressive strength, water absorption and volumetric change.

Properties in the fresh state: adding gypsum results in low fluidity, fast setting time and maximum temperature depends on the amount of gypsum in the blend. This shows the need for additives to improve flowability for practical application.

Properties in the hardened state: compressive strength improved with the addition of recycled gypsum. The exposed plaster specimens showed a significant loss of strength. Absorption increases with the gypsum content in the mixture. There were no significant dimensional changes in pastes.

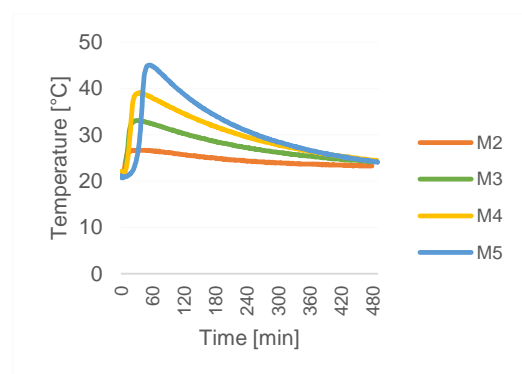


Image 1. Kinetic temperature

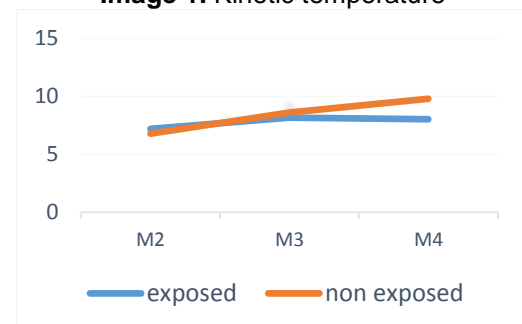


Image 2. Compressive strength at 28 days.

### Conclusions

Gypsum-cement blends performed well, mainly in the hardened state, when durability is a major factor. The result sees possible applications of the mixture in external environment with no damage to the material caused by expansive reactions.

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<sup>1</sup> CAMARINI, G., DE MILITO, J.A. Gypsum hemihydrate-cement blends to improve renderings durability. **Construction and Building Materials**; Vol. 25, pp. 4121-25, 2011.

<sup>2</sup> PINHEIRO, S.M.M. **Gesso reciclado: avaliação de propriedades para uso em componentes**. Tese de doutorado, Universidade Estadual de Campinas, SP, 2011.