

Mechanical behavior and load-bearing capacity of components made from sustainable lime-paper material

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Abstract

The efforts of the national states to significantly reduce CO₂ emissions will have a major impact on the construction industry. In particular, production of gypsum, which is mainly obtained by flue gas desulfurization, will decrease. A replacement of gypsum by sustainable lime-paper, mainly produced from secondary raw materials, is considered for various applications. In this paper, the mechanical properties of components feasible with lime paper are investigated and compared with the requirements of the construction elements.

Keywords: lime-paper, secondary raw materials, replacement materials, sustainability, strength.

1 Introduction

Climate change and the efforts of states to significantly reduce CO₂ emissions require considerable efforts in the construction industry. In general, about a third of CO₂ emissions can be attributed to the construction sector.

Interior components in particular offer the potential to test new building materials due to the low requirements for building law, statics and building physics.

Gypsum is an essential finishing material, especially in the form of plasterboard.

More than 50% of the gypsum available on the German market is FGD gypsum. This is a cheap byproduct during the flue gas desulfurization of exhaust gases from coal-fired power plants.

Due to the German cut of coal-fired plants, around 5 million tons of gypsum will be missing from 2038. This results in a clear deficit in the raw material availability of gypsum and the building products obtained from it, such as plaster boards, gypsum plaster, gypsum blocks. Even an increasing production of natural gypsum cannot replace the missing FGD gypsum.

It is therefore urgent to replace the loss of FGD gypsum by alternative products with similar

mechanical properties, that can be produced at similar cost and in an adequate volume worldwide. In addition, however, these building materials must also be compostable, non-toxic and meet sustainability criteria. This is a major and responsible task in the construction industry.

2 Gypsum Alternatives

With the foreseeable shortage of FGD gypsum, it is expected that in order to secure the gypsum quantities, in addition to increasing the mining of natural deposits, great efforts will be made to improve the recycling rate. Improved recycling is one way to achieve greater sustainability and is definitely to be welcomed.

There are also efforts to replace gypsum. However, this is currently proving difficult, as no suitable recycled gypsum substitute products exist to date. In [1] the authors comprehensively describe the life cycle assessment of traditional building materials like gypsum and gypsum plasterboards and furthermore the aspect of increased application of recycling materials for replacing the gypsum for interior fitting uses.