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Calcium silicate board as wall-facade

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Abstract

Wall as spatial partition and facade of a building gives impact not only for building aesthetic, but especially for the occupant's convenience. In the preference of wall material, especially for high rise apartments, hotels or offices, its mass/m2 and its noise reduction become an important criteria that must be considered by the building owner and architect in order to give a more lightweight construction and a quieter interior for occupant's convenience and privacy. In this paper, lightweight material that has been investigated is calcium silicate board, as an alternative to brick as a common wall material. The findings of this research, by flexural strength test in normal condition, are generally categorized in class 2 and 3. By soak-dry test as durability test for outside uses, there are no cracks found in all samples and the flexural strength decreases but less than 30% so that it meets the SNI 7705:2011 standard. By warm water test, this material cannot withstand against temperature at 60 degree centigrade or higher. By heat and rain test, this material can withstand the heat and rain conditions. By noise reduction as sound isolating enclosure, this material is unable to perform as a noise barrier.

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Keywords: calcium silicate board; durability; flexural strength; noise reduction

1. Overview

Construction development nowadays is supported by the newest invention in building materials. A more lightweight, more sustainable and easier installation material is being considered in material preferences. In the preference of wall material, especially for high rise apartments, hotels or offices, its weight (mass/m^2) and its noise reduction become an important criteria that must be considered by the building owner and architect in order to give a

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more lightweight construction and a quieter interior for occupant's convenience and privacy. Such preference of lightweight wall material, being researched here is calcium silicate board.

2. Calcium silicate board in building construction

Calcium silicate board mainly consists of inorganic material such as silica sand, Portland cement, cellulose and water. It is widely used as an alternative to gypsum and asbestos cement board that have some disadvantages. Asbestos cement board gives a bad influence to building occupants health, while the gypsum board will dissolve in the water so that it cannot be used on the building exterior.
Formerly calcium silicate board was used for indoor partition and ceiling, but later it is widely used for wall facade as it is waterproof, lightweight, has a wide dimension and is easy to install; even it is the solution for a sloping and bending opaque wall surfaces. That is why it has the advantage compared to the brick wall and lightweight concrete. Compared to lightweight concrete, it has the same drywall construction, but at a lower cost.

Fig. 1. Calcium silicate board uses as façade and room partition

Besides its advantages, some of the disadvantages are the high installation cost compared to gypsum and asbestos; and it has limitation in its rain, heat and fire resistance. That is why some modification are needed.
A research in cold-formed steel wall frame with calcium silicate board sheathing conducted by Lin, Pan and Hsu [1] noted that the crack happened mostly at the bottom of the track of wall specimen. That is why modification of the wall with calcium silicate board sheathing is needed. Wang, Chuang and Lin [2] studied the performance of calcium silicate partition fireproof drywall assembly with a junction box and found that the quality of the calcium silicate board plays a big role in the fireproof effectiveness. Different composition may impact the heat and fire resistance of this material. The poorer formula it has, such as substitution of cement with the coal ash to reduce the production cost; the poorer its fire-proofing will be. Since this material needs modification in its application in many kinds of performances, this paper aims to find its capability as facade material by flexural strength test, warm water test, soak-dry test, heat-rain test in tropical climate as well as the sound reduction test.

The warm water test was needed to know its flexural strength due to increase in temperature, compared to normal condition. The soak-dry test was done to get known the flexural strength after soaking in the water and dried while the heat-rain test was conducted to find its durability against the rain and the heat of the sun. The sound reduction test was conducted to find its noise reduction as sound isolating enclosure. The samples were taken from 2 different kinds of thickness and 4 brand products in Indonesia for each thickness ; the 6mm was used for outside ceiling, while the 8 mm thickness was used for outside wall or facade.

3. Flexural strength of calcium silicate board

According to SNI (Indonesian National Standard) 7705:2011[3] the flexural strength standard of calcium silicate board is as follows: