Application of Lightweight Calcium Silicate Wall Panel Board

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Keywords: Static Cutting; Reinforced Concrete; Construction

Abstract: In this paper, through the material properties, construction technology and characteristics of lightweight calcium silicate wall panel board introduction, the construction method of lightweight calcium silicate wall panel board is expounded, the difference between lightweight calcium silicate wall panel board and ordinary masonry wall is analyzed, and the application and specific characteristics of lightweight calcium silicate wall panel board in civil building is discussed.

1. Introduction

With the development of the city process, our country is vigorously developing and popularizing the green new building materials at the present stage, the building materials industry follows the green development, the circular development and the low carbon development, and promotes the transformation and upgrading of the building materials industry, and to support development of prefabricated building[1].

Lightweight calcium silicate wall panel board is a non-load-bearing lightweight composite sheet with calcium silicate board as the panel, through filling a light core material in the middle by composite forming[2]. On the basis of the digestion and absorption of the latest technology and production processes at home or abroad, and combining China's building materials standards and quality control system, it is a new wall building materials to meet the requirements of “green, environmental protection and energy saving and waste utilization”.

2. Material properties

Lightweight calcium silicate wall panel board have characteristics of solid core, lightness, thinness, high strength, fire prevention, waterproof, anti-moisture, heat insulation, noise insulation and so on. It doesn’t have harmful substances, and certified by the national environmental protection, and it has radioactive, non-polluting environmental protection functions, so it belongs to green materials[3].

2.1 Fire prevention.

Fire resistance of Lightweight calcium silicate wall panel board under high temperature 1000 degrees Celsius can endure more than 4 hours, and will not distribute toxic and harmful gases, and its non-combustible properties can meet the national A-level standards. Fire resistance can limit the fire and smoke gas in the fire area to prevent the spread of fire to block the generation of toxic gases (or effective isolation), so that officers have enough time to evacuate and fight the fire to provide more security guarantee to others.

2.2 Waterproof and moisture-proof.

Lightweight calcium silicate wall panel board is the calcium silicate board, with good water resistance and moisture resistance, which can be used for kitchen, bathroom, basement and other wet areas. Therefore, looseness, loss, deformation, decreased strength will not appear in lightweight calcium silicate wall panel board due to moisture absorption. Experiments show in the absence of

  DOI: 10.25236/msied.2018.036

any waterproofing treatment, when a pool made of cement is filled with water, the surface of the wall using lightweight calcium silicate wall panel board can be kept dry without leaving any traces, and there will not be condensed water bead phenomenon in the wet weather, which fully shows waterproof and superior moisture resistance of lightweight calcium silicate wall panel board.

2.3 Insulation.

Building energy efficiency is the focus of the current construction industry, the public building energy efficiency design standards and residential building energy efficiency design standards promulgated on July 1, 2005 requires 50% energy saving of future energy-efficient building design on the basis of taking energy-saving measures for construction. To achieve this goal, a large number of solid composite wall panels will be used to enhance good thermal indicators of building palisade structure[4]. Constituent materials of lightweight calcium silicate wall panel board formed through steam curing with high temperature and high pressure of high-purity quartz powder, inorganic fiber and plant fiber, and its own internal honeycomb structure ensure its good thermal insulation function, so it is the ideal product of energy-saving plate of indoor and outdoor partitions of buildings, and it can automatically adjust indoor air moisture content with seasonal and climate change, so that the humidity can maintain a level of balance to achieve ecological regulation to make your indoor environment more comfortable, so it is in line with the development trend of modern residential construction.

2.4 Sound insulation.

The surface of lightweight calcium silicate wall panel board is cement calcium silicate board, and inner core is full of polystyrene composite particles, which have a function of good sound-absorbing and sound insulation, sound insulation of wallboard with100mm thickness is 46dB, much higher than sound insulation effects of other brick walls, and the sound insulation is in line with national housing sound insulation requirements.

2.5 Environmental protection and energy saving.

Lightweight calcium silicate wall panel board materials does not contain harmful substances, belonging to A -level non-radioactive products, and being in line with national JG / T169-2005 standards,and the scope of application is not subject to any restrictions, so it is a kind of green building materials certified by the State Environmental Protection Administration[5].

3. Construction

Lightweight calcium silicate wall panel board have characteristics of easy to cut, no plastering, dry operation(which can also be nailed, hanged, sawed, and can support tiles) and other the construction advantages that other wall materials can not match.

In the wall panel installation parts, the baseline should be vertical to the bottom of the floor or the bottom of the vertical base line to ensure that the flatness and verticality of the installed wall board, and identify the location of openings; after wall panels enter the scene, according to the thickness of the board, the panel should be carried to the installation site of the wall board by machine or people. The whole board specifications are: the width is 610mm, and length is 2440mm. When the width or height of the wall-side is not enough for a whole board, you should use the patch, and cut it freely to adjust the width and length of wall panels with the portable machine according to the requirements to make wall panel loss rate decreased. Add water into the caulking pulp for professional installation in proportion, and then wipe with a damp cloth to clean the surface dust of concave and convex chamfer of the wall, and wet concave and convex chamfer with a brush, and then professional polymer mortar for filling in the groove of the wall board and within the baseline of the floor.

Move the wall panel with mortar to installation location, erect from top to bottom on a good baseline, pry the wall panel with a wick from the bottom, put forth your strength to make the board tightly close to each other, and make mortar polymerization material extruded from the joint, and

then scrape off slurry bulging the wall panel surface. We must ensure that the slurry between the board and board full, and finally make it temporarily fixed with a wooden wedge.After the initial assembly of the wall board, use professional jimmy to adjust, use 2M direct foot for inspection flatness and verticality.After the installation and correction, temporarily fix wall panels with wooden wedge, and in the connection with the floor (bottom and top), or connection between two adjacent wall panels, or upper and lower connection of wall panels, except polymer mortar, 6 or 8 reinforcing steel bars with 200～250mm should be used for reinforcement (penetration part of reinforcing steel bar into the wallboard should be greater than 100mm). The plate with thickness of 125mm must be driven into two reinforcing steel bars.

After the installation of wall panels with the joints, scrape off the wall surface joints mortar, and hook out the joints, generally not less than 4 ~ 5mm of the board, this step is for the wall seams treatment. Seven days after completing wall installation process, start filling the seam between upper and lower joints and between the boards with professional polymer slurry on the maintained wall, and pull out the original wedge and make it filled with mortar. Remove the dust on the surface of joints before grouting, and then plunge caulking materials into the joints mouth of wall board with the scraper uniformly; Wait 6-8 hours after completing slurry, start seam processing of the next process.

Bury line pipe. Release line in the position where the switch and wire box will be set, and then cut and open slot with a portable saw, and fill it with paste mortar after the installation is completed. Reserve hole of doors and windows in the installed wall, freely use the splint or line for anchoring. In the installed wall, directly apply putty, and then brush paint or paste wallpaper[6].

4. Comparative analysis of lightweight calcium silicate wall and masonry wall

Comparison of weight and construction of lightweight calcium silicate wall panel board and masonry wall are shown in Table 1 and Table 2.

Table 1 Comparison of weight of the two walls

Lightweight calcium silicate wall panel board 500m^2			Standard brick construction 500m^2		
Name	Wall board with thickness of 75mm	Wall board with thickness of 100 mm	Name	Standard brick with thickness of 150 mm(lime sand brick)	Standard brick with thickness of 180 mm
Weight of the wall board [ton]	26.5	32	Weight of the wall board [ton]	80	120
Installation mortar [ton]	2	3	Masonry mortar[ton]	11.5	20.6
Plastering is not needed, and putty can be directly applied on the surface.			Pastering is needed on both sides[ton]	80	80
Total[ton]	28.5	35	Total[ton]	171.5	220.66

Table 2 Comparison of construction of lightweight calcium silicate wall and masonry wall

	System composition	Construction method	Bury line, pipe, and open hole	Alteration and secondary decoration
Building blocks	To have beam and column support, when it is beyond the 3.5m, it is necessary to increase the ring beam and structural columns	Slow speed, strong and dirty wet construction	Heavy workload, high labor intensity	Due to the location of the beam, transformation is difficult.
Lightweight calcium silicate wall panel board	No installation of beams, columns, and when it is beyond 6m, it is recommended to increase the steel structure.	Fast speed, small operating intensity, clean and sanitary	Small workload and low labor intensity	Free from the influence of beam and column position, arbitrary layout, and easy to transform.

Through contrast, we can know that: the wall with the same construction volume, the calcium silicate lightweight wall is 6 times lighter than the ordinary masonry wall, and the calcium silicate lightweight wall board do not need to plaster, and the surface can be directly scraped putty, which can save a process. From the construction aspect, calcium silicate lightweight wall board has lower requirements for secondary structure, which can reasonably reduce the arrangement of constructional column and girder.

Through practical engineering, it can be seen that the construction of the calcium silicate lightweight wall board belongs to the dry work assembly construction. If the wall height is less than 4 meters, on the average, a skilled worker will be able to ship more than 30m2 a day, and plastering is not needed in double sides of the wall board, and compared with masonry wall construction, the efficiency is improved by 13 times. Wall panels can also be cut for adjusting width and length according to the needs of any structural requirements, reducing the rate of material loss and construction waste and shortening the duration.

5. Conclusion

Lightweight calcium silicate wall panel board not only have the advantages of sound insulation, waterproof, anti-moisture and other basic superior performance, but also have high load-bearing capacity, anti-static electricity, anti-friction, high strength, easy laying, corrosion resistance, no deformation, no cracking and other outstanding advantages. Its lightness and high-strength can decrease supplies and increase safety; its simple construction and installation process can significantly shorten the construction period, so it has high comprehensive cost performance. It can meet the aim of "improving construction efficiency, reducing cost and increasing the area of the inside space".

Lightweight calcium silicate wall panel board can be widely used in factories, hotels, schools, hospitals, shopping malls, office buildings, apartments villas, stadiums, conference center, and renovation of old buildings project, which can meet customers’ diverse needs of the indoor and outdoor decoration of the new construction.

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