

Technology Study on Cast Lightweight Composite Insulation Wall

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Abstract. Cast lightweight composite insulation wall is a new, energy-saving, environmentally friendly wall materials, this article from cast lightweight composite wall construction technology, quality standards and other aspects of the construction of lightweight composite wall cast a more comprehensive exposition, to clarify the key construction technology, materials properties, development advantages and other aspects of cast lightweight composite wall. It has certain significance on future construction of such walls.

Introduction

The National College Students' innovation and entrepreneurship training project - Technology study on cast lightweight composite insulation wall is a green energy research for the subject, the development of economic rationality, wall research resource utilization. Cast lightweight composite insulation wall process of this project is a very important study. Development of green building, promote the rational use of nergy-saving, resource, economy is now the goal of building the and the future, and cast lightweight composite insulation wall is a kind of industrial waste tailings powder as the main raw material, lightweight environmentally friendly materials subject to the wall, well implemented a new wall thrust of energy saving and environmental protection, resource utilization.

Wall Profiles

Cast lightweight composite insulation wall is the use of light steel keel and cement ressure plate [1] formwork, using intelligent continuous perfusion device, forming a molding composite wall poured into the new lightweight rigid insulation material on-site. The new lightweight rigid insulation material with a large number of tailings powder and other industrial waste as the main raw material, forming a unique formula by adding self-developed compound additives, producing a new insulation building material applied chemical foaming technology instead of a physical foaming technology. Its basic structure is based on light steel keel frame, both sides covered with fiber cement slab, hollow part of mechanical equipment on site to use special stir bead light slurry filling, surface decoration processing directly formed. It has the advantages of light weight, heat insulation, insulation, good seismic performance, and ease of use of industrial waste residue can be a lot of good, has a good economy. [2]

Wall Technology [3] [4]

Cast foam concrete wall insulation [5] is fixedly connected with the use of light steel keel frame and special plate with the main building, forming a wall skeleton and panel, simple construction process, wall forming speed, stable quality, the construction process does not produce dust, waste gas, waste water and waste residue, green environmental protection, work arrangements primarily for wall designing, scaffolding, keel installation, panel mount, wall placement.

Wall Skeleton

Light steel keel [6] installation contains keel rust, scale, cutting, transverse keel connection with

the structure of beam plate with nail, vertical keel and transverse keel connected with pulling nail and other construction process. Requirements: transverse keel using U75 * 40 * 0.6mm type transverse keel, the spacing of nail fixed the upper and lower transverse keel with the structure should be less than 800mm; and the spacing of vertical keel fixed with transverse keel should be less than 600mm, keels connected with rivet. Vertical using C75 *45 *0.6mm type vertical keel, the small cross section of mandrel mouth part below and the large cross section at the top. The keel and the panel, column beam contact parts in anti-rust treatment (brush anti-rust paint); The gap between both ends of the upper and lower transverse keel and the main structure columns and walls should not be less than 30mm, or the upper transverse keel open 50mm*10mm exhaust port; through-keel and card installation includes scale, cutting, doing type, and nail connection with column and other construction process. Requirements: vertical keel support card spacing should not greater than 400mm, horizontal through-keel spacing should not more than 1m, when vertical keel need to pick up long, it should adopt the lap joint, lap joint lining keel length should not be less than 200 mm, and fixed by rivets, each side should not be less than 2. In figure 1.



Fig. 1 Keel Installation



Fig. 2 Fiber Cement Pressure Plate Installation

Wall Panel

Panel material contains scale, elastic line, cutting and other construction process. Requirements: according to the wall actual size typesetting material, avoid waste. Safe and civilized construction attention during construction, workers pay attention to personal safety, on-site requirements have dustproof measures, diced cement board, level must be neat, and there should not be peeling off angle, hollowing and cracks. Cement pressure plate screw nest cannot too deep, requiring more than 1mm and less than 2mm in depth. Cement pressure plate installation includes handling, scaffolding, position adjustment, self tapping screw connection and other construction process. Requirements: when installing first outside, the outer panel with high density 10mm thick, wall inner panel with medium density 10mm thick, cement board and light steel keel connected by #8*25~35mm self drilling screws, the screws spacing of plate edge is 150mm, the middle part of the screw spacing is 200mm, cement board with countersunk head tapping screws fixed keel, tapping screws spacing should be less than 200 mm, the self tapping screw cement board edge distance is 10mm ~ 15mm, after tightening the self-tapping screws into the top surface should be slightly concave surface of the plate under 0.5mm ~ 1mm, when the self-tapping screws flat, it should be carried out to the surrounding intermediate plate. Tapping screw plate edge spacing should be less than 150 mm. Self tapping screw cap must be anti-corrosion treatment. Expansion bolt diameter should not be less than 8 mm for fixing in the wall, nail diameter should not be less than 3mm; the inside plate installed first onto the windowsill height, above the height gradually installed with the construction height, shown in figure 2.

Partition installation includes scale, cutting, tapping screw installation, and clay plugging construction process. Requirements: before paving cement pressure plate it should be installation and fixation for the hydropower facilities pipeline, line box according to the drawings requirements ,

when hydropower embedded pipeline in the wall need to pass through the upper and lower transverse keel, should be opening on the corresponding position in the middle part of the keel with reamer, the opening width should not be more than the cross section of the keel width 1/2; between wall pouring range each 1~3 meters provided with a clapboard, to facilitate the wall segment pouring construction, and sealing measures to prevent foam cement slurry into the adjacent space.

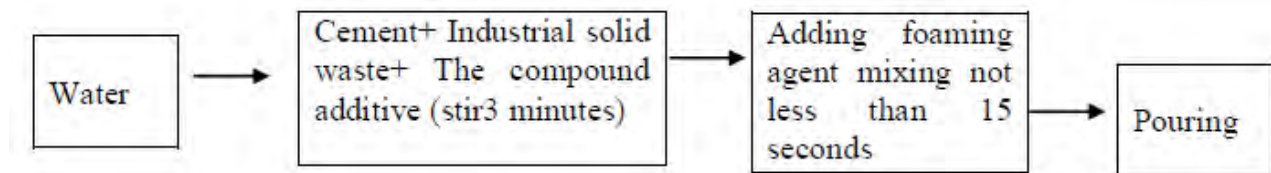
Seam Clay Plugging, Tapping Screw Rust

Cement pressure plate and structural surface or plate and plate gaps sealed with mastic sealing; left 3-5mm seam between panels, a cloth two pulp treatment, brushing interface agent in advance, mesh width of 100mm, cement flat plate vertical edge and vertical keel should be fixed, and both sides of the same keel cannot occur spell slot at the same time; cement board level to the connecting surface without keel, must be added 50 transverse keel back keel to strengthen the connection of cement pressure plate; joint mortar must comply with the requirements of flatness and verticality, thickness less than 1.5mm; after tightening tapping screw surface point coated with antirust paint.

Wall Pouring

Pouring bottom core material, it is about 500mm high. Determination of slurry construction mixture ratio according to design and process requirements before construction, and adjusted through the trial; there should be person responsible for ingredients according to mix ratio adjusted in the construction site. Before pouring wall every time, it must debug the equipment, including the main equipment and two time mixing equipment. Need to test content, liquid amount is accurate, circuit, switch is intact. Found that the problem should be timely adjustment and maintenance. Slurry using intelligent continuous perfusion machine casting, and according to the shown sequence feeding; mixing time of raw materials all invested should not be less than 3 minutes, and mixing with a foaming agent should not be less than 15 seconds. Cast-in-situ foam concrete insulation wall has broad prospects for development, not only has the advantages of light weight, quick installation, high construction efficiency, and energy saving, thermal insulation, fire resistance rating high, low cost, and can be widely used in modern architecture.

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Note

(1) Slurry casting should be after keel and cement plate installation acceptance; before pouring wall each time need to check whether the template closed intact without leakage, reinforcing device is installed. Found that the problem should be timely closure;

(2) Pouring slurry construction process, it should be protected embedded water pipelines within the wall is not destroyed, embedded boxes, cabinets, boxes with non-deformable displacement;

(3) Slurry stratified pouring, pouring slurry construction process, must according to the template interval control pouring time and pouring time are given by the R & D department according to the formula, equipment power as well as the template size of interval comprehensive evaluation, calculated and determined according to the engineering actual situation. It also needs to control the slurry into the template height, preferably not more than 200mm. The ultimate guarantee of each layer of slurry initiated the height of not more than 600mm. Interval of two layer slurry casting is prevail not to mould expanding, and should not be less than 4 hours, when necessary, take the pouring technology of temporary reinforcement measures or adjust slurry;

(4) In slurry casting process, casted parts and pouring opening height should be paid attention, avoid pouring slurry overflow; when the wall casting parts and building structure plate is less than or equal to 600mm, it should be calculated size amount of bets, ensure that no gap between slurry after molding and building structure board;

(5) Reasonable arrangement process, non-inverted construction process work, core filling materials inside the wall dense and homogeneous.

Conclusion

Cast-in-situ foam concrete insulation wall stable quality, simple process, and fast forming speed, with construction of high efficiency, low cost, energy saving and environmental protection, to achieve the rational use of resources.

Cast-in-situ foam concrete insulation wall is a new type of material wall, has many excellent properties, but there are still many deficiencies need to be improved. And our country is developing the energy conservation, ecological environmental protection, and resource utilization at present. Cast-in-situ foam concrete insulation wall is a type of a high performance and more economical wall. Its prospects are very broad, currently being further theory and practice to solve some problems, hope to get better application in practice.

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References

- [1]JGJT 157-2008, Building lightweight slat wall technical specification [S]. Beijing: China Building Industry Press, 2008.
- [2]“Cast foam concrete composite wall technology” Yan Zhenjia He Yanjun Chemical Industry Press, May 2013.
- [3]Chen Qinghua. Lightweight foam concrete cast-in-place wall construction method [J]. Building materials and decoration, 2013, (13): 103-105.
- [4]Liu Li. Process Study on foam concrete self thermal insulation wall [D]. Southwestern University, 2013.
- [5]DB21 / T1888-2010, Insulation decorative composite panel exterior wall insulation engineering point of order [S].
- [6]GBT11981-2008, Building with light steel keel [S].