

LAYERED CEMENT BOARD AND METHOD OF MANUFACTURING A LAYERED CEMENT BOARD

Technical Field

[0001] The present disclosure describes embodiments generally relating to a layered cement board capable of use in the building and construction industries. Further, a method of manufacturing a layered cement board is also provided.

Background

[0002] Fiberboards, which can be understood to be an engineered wood product, and are typically made up of wood chips, sawdust, plant fiber and other materials, bonded with resin and compressed into sheets or boards, have been used widely as a viable alternative to solid wood in building and construction, in furnishings, and for various other purposes. There are many kinds of fiberboards, which are commonly classified under low-density fiberboards, medium-density fiberboards, or high-density fiberboards, each category of which typically include identifying properties which can be standardized.

[0003] Various kinds of fiberboards can include recycled products in its composition. For example, waste paper product or waste wood residue or other products can be included in the manufacture of fiberboards. Other types of recyclable materials have also been making their way into such multi-purpose boards. Utilizing various materials as multi-purpose boards provides for various advantageous properties to be introduced. For example, unwanted plastics can be molded together into a plastic board, and such plastic boards can be highly insensitive to electrical conductivity and do not suffer from decomposition. Such fiberboards have been used in various applications, for example, as wall partitions.

[0004] Cement boards have also been utilized as wall partitions, offering better long-term performance as they typically do not physically break down in the presence of moisture nor do they decompose. Cement boards are typically formed with a hydraulic cement, which can include pozzolana or fly ash, which can be a by-product in a combustion process, and can be recycled in the formation of a cement board. Cement boards are known to have a higher load capacity than fiberboards, and are also generally fire resistant and work very well in moist environments as it includes good drying properties. Cement boards are also formed as a single layer for any thickness, the manufacturing as such capable of adapting to various requirements for thickness. Concrete is a composite material that includes and is bound together by cement in its composition, and as such, sometimes cement boards have also referred to as concrete blocks.

[0005] The present disclosure thus seeks to provide alternatives in the area of such board formation and products for use in applications such as wall partitions, which provide favorable utilization properties with fewer or negligible drawbacks.

Summary

[0006] According to various embodiments in the present disclosure, there is provided a layered cement board including a plurality of polymeric fabric layers; and a plurality of cement layers, the plurality of polymeric fabric layers being interlaid between the plurality of cement layers; wherein the plurality of polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14 pH.

[0007] According to various embodiments in the present disclosure, there is provided a method of manufacturing a layered cement board, including: providing a base panel; depositing a first layer of cement on the base panel, the first layer of cement arranged to be vertically deposited onto the base panel; overlaying the first layer of cement with a first

polymeric fabric layer; depositing a second layer of cement on the first polymeric fabric layer and overlaying the second layer of cement with a second polymeric fabric layer; and compressing the interlaid layers of cement and polymeric fabric on the base panel with a set of rollers; wherein the polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14.

Brief description of the Drawings

[0008] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, with emphasis instead generally being placed upon illustrating the principles of the present disclosure. It is to be noted that the accompanying drawings illustrate only examples of embodiments of this disclosure and are therefore not to be considered limiting of its scope, for the disclosure may admit to other equally effective embodiments. In the following description, various embodiments of the disclosure are described with reference to the following drawings, in which:

[0009] FIG. 1A and FIG. 1B illustrate a layered cement board according to an embodiment.

[0010] FIG. 2A and FIG. 2B illustrate a layered cement board according to a next embodiment.

[0011] FIG. 3 illustrates a block diagram for a method of manufacturing a layered cement board according to an embodiment.

[0012] FIG. 4 illustrates a block diagram for a method of manufacturing a layered cement board according to a next embodiment.

[0013] FIG. 5 illustrates a block diagram for a method of manufacturing a layered cement board according to a following embodiment.

[0014] FIG. 6 illustrates a manufacturing system layout in which a method of manufacturing a layered cement board can be carried out.

Detailed Description

[0015] Embodiments of a layered cement board are described in detail below with reference to the accompanying figures. However, it should be understood that the disclosure is not limited to specific described embodiments. It will be appreciated that the embodiments described below can be modified in various aspects, features, and elements, without changing the essence of the disclosure. Further, any reference to various embodiments shall not be construed as a generalization of any inventive subject matter disclosed herein and shall not be considered to be an element or limitation of the appended claims except where explicitly recited in a claim(s).

[0016] According to various embodiments, depiction of a given element or consideration or use of a particular element number in a particular FIG. or a reference thereto in corresponding descriptive material can encompass the same, an equivalent, or an analogous element or element number identified in another FIG. or descriptive material associated therewith. The use of “/” herein means “and / or” unless specifically indicated otherwise.

[0017] The present disclosure can describe embodiments of a device or apparatus or system which can be operable in various orientations, and it thus should be understood that any of the terms “top”, “bottom”, “base”, “down”, “sideways”, “downwards” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of a system or apparatus.

[0018] According to various embodiments in the present disclosure, there is provided a layered cement board including a plurality of polymeric fabric layers; and a plurality of cement layers, the plurality of polymeric fabric layers being interlaid between the plurality of

cement layers; wherein the plurality of polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14 pH.

[0019] Providing such a layered board of cement and fabric provides various advantages over cement boards presently provided, for example, for use in applications such as wall partitions. The fabric layer or layers within the layered board provides for additional durability in such a board according to various embodiments. For example, tests carried out in samples of a layered board according to present embodiments show that such a layered board includes a greater durability than regular cement boards. Such a layered board can include a higher impact resistance, and in instances when the layered board is cracked or fractured, the layered board retains its structural integrity and does not disintegrate or crumble.

[0020] In addition, a layered board according to various embodiments also includes a measure of flexibility, which is provided by the interlaid fabric layers. In performance tests, such a layered board is progressively bent at opposing ends for up to about 45° tangentially. The test outcome provides a surprising result in that not only does the layered board not snap or break, the layered board substantially reverts to its original shape or profile. The layered board is thus provided with resilience against bending or folding. Such unique characteristics provide a layered board according to various embodiments with a high tensile strength to thickness ratio, allowing for manufacturing of layered boards with a slim profile for wall partition applications.

[0021] The technical basis of providing a layered cement board according to various embodiments is now discussed.

[0022] FIG. 1A and FIG. 1B illustrate a layered cement board according to an embodiment. FIG. 1A shows a front view of an embodiment of layered cement board 100, which can be alternatively referred in this description or otherwise as “cement board”,

“layered board”, “multi-layered cement board”, or “multi-layered cement fabric board”. FIG. 1B illustrates a perspective view of layered cement board 100. Layered cement board 100 can include a plurality of cement layers 110 interlaid with a plurality of fabric layers 120. In an embodiment, layered cement board 100 can include cement layers 112, 114, interlaid with fabric layers 122, 124. In various embodiments, the layered cement board can include where two cement layers sandwich a fabric layer.

[0023] Layered cement board 100 can include where the thickness of a cement layer is substantially larger than the thickness of a fabric layer. Similar to typical cement boards, the density, durability and various other advantageous properties, arise from the cement in the board. In layered cement board 100, the cement board is substantially composed of cement. Fabric layers 120 are provided in layered cement board 100 to further accentuate the durability of the layered cement board. Providing a fabric layer in the board serves to overcome brittleness in the cement board, which can break when subjected to stress, in view that the physical properties of cement do not allow for much strain or deformation. The determination of the number of fabric layers in the cement board are designed to be balanced with the amount of cement in the layered cement board. The fabric layers are intended to be included in the layered cement board without compromise to the mechanical properties of a typical cement board.

[0024] The fabric layer allows for the layered cement board to retain its integrity, even under high stress situations. The layered cement board is further capable of receiving multiple localized heavy impacts, for example, from a hammer blow onto the cement board, and not fracture. Such durability is highly desired, for example, in situations where the layered cement board is installed in areas which may experience harsh conditions.

[0025] Layered cement board 100 can be cut to specification for multiple purposes. In embodiments, cement board 100 can be cut to a substantially square shape for use in for

example, a wall tile. The layered cement board 100 can be cut with a special saw capable of cutting through such a high-density material. In instances, such a layered cement board is prepared for utilization and segmented with a carbide-tipped saw blade. In embodiments, the layered cement board can be fabricated to certain dimensions in the manufacturing process, which saves additional effort in post-production processing.

[0026] In various embodiments, a cement layer 112 can form the bottom layer of the layered cement board 100, while a fabric layer 124 can form the top layer of the layered cement board 100. The bottom cement layer 112 is typically the initial layer provided during the manufacturing of the layered cement board. In preparing the layered cement board for installation, various additional barriers or layers can be provided on the top or bottom layer of the layered cement board. For example, a waterproofing barrier can be applied onto the cement layer 112 to provide additional durability for installation in moist or wet environments. Additional barriers and layers can also be provided on the fabric layer. In embodiments, the top layer of the layered cement board can be formed with a cement layer. This allows for both sides of the layered cement board to be provided as cement, for a relatively homogeneous application, regardless of which face of the layered cement board to be applied.

[0027] According to various embodiments, the fabric layers 120 include a polymeric fabric layer. In embodiments, the fabric layers include a polyolefin fabric layer, a thermoplastic polymer fabric layer, or a polyamide fabric layer. In embodiments, the fabric layers include a polypropylene fabric layer, a polyethylene fabric layer, a polytetrafluoroethylene fabric layer, a polyvinyl chloride fabric layer or an acrylic fabric layer. In embodiments, the fabric layer is substantially chemically inert in an alkaline environment of about 12-14 pH.

[0028] FIG. 2A and FIG. 2B illustrate a layered cement board according to a next embodiment. FIG. 2A shows a front view of an embodiment of layered cement board 200, while FIG. 2B illustrates a perspective view of layered cement board 200. In various embodiments, layered cement board 200 can include a plurality of cement layers 210 interlaid with a plurality of fabric layers 220. In an embodiment, layered cement board 200 can include cement layers 212, 214, and 216, interlaid with fabric layers 222, 224 and 226. Layered cement board 200 includes three layers of cement interlaid with three layers of fabric. In other embodiments, additional numbers of fabric layers can be interlaid with cement layers to provide for additional durability in the layered cement board.

[0029] Layered cement board 200 can also include a plurality of meshes 230 interlaid within the layered cement board 200. In embodiments, a mesh layer 232 can be provided on or after a bottom layer 212 of cement layer in the layered cement board 200. In embodiments, mesh layer 232 can be a fiberglass mesh layer. Mesh layer 232 can be a fiberglass-formed thin barrier layer, which can include a criss-cross pattern as a net or web. Such a mesh provides additional structural reinforcement when overlaid into the layered cement board. Mesh layer can be an alkaline-resistant fiberglass mesh layer, which preferably does not deteriorate within the layered cement board. In fabrication, mesh layer 232 can be introduced to the cement layer 212 before the cement layer 212 fully sets.

[0030] As the mesh layer 232 includes multiple through-holes in the net-patterned layer, cement in the cement layer 212 freely seeps through the mesh, and the cement layer 212 is formed about the mesh. It can be noted that FIGs. 2A and 2B is exaggeratedly illustrated to indicate the provision of a mesh or a plurality of mesh layers within the layered cement board. Such mesh layers may not necessarily be seen on an actual sample of an embodiment, even less so neatly provided in between cement and fabric layers.

[0031] In embodiments, a second mesh layer 234 can be provided. Mesh layer 234 can be provided after the application of the third cement layer 216 over the second fabric layer 224, and before the third fabric layer 226 is provided over the third cement layer 216. In various embodiments, a mesh layer can be provided in or on each cement layer. This further includes structural integrity of the layered cement board.

[0032] FIG. 3 illustrates a block diagram for a method of manufacturing a layered cement board according to an embodiment. Method 300 is provided, and in various embodiments, manufacture of a layered cement board according to method 300 can result in the layered cement board 100 of FIG. 1. Various steps of the method 300 are described. Notwithstanding the order in which the steps are described, it is clarified that the steps can be performed in any order suitable for a desired end result. In step 302, in the manufacture of a layered cement board, a base support is provided, the base support providing a platform where the layered cement board can be manufactured or fabricated upon.

[0033] In step 304, a first layer of cement is deposited on the base support. In embodiments, the layered cement board is manufactured over a conveyor belt arrangement, which carries the base support along the belt and to various stations in the manufacturing process. The first layer of cement can be provided on the base support and smoothened out, either with an automated scraper, or through a manual process. The first layer of cement is then provided or overlaid with a fabric layer, as in step 306. Such a fabric layer can be a polymeric fabric layer. Further, such a fabric layer can be a polypropylene fabric layer. A polyethylene fabric layer can also be provided in the layered cement board.

[0034] In step 308, a second layer of cement can be deposited, on the first fabric layer. The cement layer can similarly be smoothened, to allow a next fabric layer to be laid on evenly. In step 310, a second fabric layer is overlaid on the second layer of cement. In step 312, the interlaid layers, or the layers already laid down or deposited or provided in the

formation of the layered cement board are compressed, to provide for an even formation of the layered cement board, and to ensure the layered cement board is manufactured to a predetermined specification. In this respect, the cement layer or layers are bonded with the interlaid fabric layer or layers.

[0035] FIG. 4 illustrates a block diagram for a method of manufacturing a layered cement board according to a next embodiment. Method 400 is provided and various steps of method 400 are described. In 402, a base support is provided, the base support providing a platform where the layered cement board can be manufactured or fabricated upon. In 404, a first layer of cement is deposited on the base support. In 406, a fabric layer is provided and overlaid on the first layer of cement. In 408, the interlaid first cement layer and first fabric layer are compressed. This results in a tight and even surface which allows for a smooth manufacturing process of multiple cement and fabric layers.

[0036] In 410, a second layer of cement can be deposited, on the compressed and smoothed first fabric layer. In 412, a second fabric layer is overlaid on the second layer of cement. In 414, the interlaid layers of cement and fabric are again compressed. In 416, a third layer of cement is deposited and smoothed over the second fabric layer. In 418, a third fabric layer is overlaid on the third layer of cement. In 420, the interlaid three layers of cement and fabric are compressed through a final set of rollers.

[0037] FIG. 5 illustrates a block diagram for a method of manufacturing a layered cement board according to a following embodiment. Method 500 is provided and various steps of method 500 are described. In 502, a base support is provided, the base support providing a platform where the layered cement board can be manufactured or fabricated upon. In 504, a first layer of cement is deposited on the base support. In 506, a mesh layer is provided on the first cement layer. A fiberglass mesh layer can be provided on the first cement layer. Such a fiberglass mesh layer can include a criss-cross structure with multiple openings or holes. The

fiberglass mesh layer then allows the cement layer to seep through and about the fiberglass mesh layer. In 508, a fabric layer is provided and overlaid on the first layer of cement. In 510, the interlaid first cement layer and first fabric layer are compressed, together with the fiberglass mesh layer. This results in a tight and even surface which allows for a smooth manufacturing process of multiple cement and fabric layers.

[0038] In 512, a second layer of cement can be deposited, on the compressed and smoothed first fabric layer. In 514, a second fabric layer is overlaid on the second layer of cement. In 516, the interlaid layers of cement and fabric are again compressed. In 518, a third layer of cement is deposited and smoothed over the second fabric layer. In 520, a fiberglass mesh layer can be provided over the third cement layer. In 522, a third fabric layer is overlaid on the third layer of cement. In 524, the interlaid three layers of cement and fabric are compressed through a final set of rollers. In step 526, the compressed layers of cement and fabric are put through a curing process, in which moisture in the cement mix is dried up and the cement solidified.

[0039] FIG. 6 illustrates a manufacturing system layout in which a method of manufacturing a layered cement board can be carried out. System 600 is provided on which a layered cement board, for example, such as the board 100 or 200 as illustrated in FIG. 1 or FIG. 2, can be fabricated or manufactured on. System 600 includes an elongate conveyor-based system, in which stages of manufacturing can be completed one after another. In the system 600, a conveyor belt 610 is provided. Conveyor belt 610 can include an elongate belt 612 provided a plurality of rollers 614, the rollers 614 capable of being driven to rotation, which subsequently drives the belt in actuation about a certain direction. In various embodiments, the belt 612 is driven clockwise about the conveyor belt system 610, doing so resulting in transporting deposited material further into the conveyor system 600.

[0040] Base support panel 620 is provided onto the belt 612 of the conveyor system 610. Base support panel 620 can be segmented into various panels, the size and dimension of the panels configured to be of user determination, typically according to the resulting application of the manufactured layered cement board. Base support panel can also be understood to be a base panel or a base support. System 600 can include a plurality of cement and fabric deposited onto the vertically arranged base support panel 620. Base support panel 620 can include several base support panels, each panel 621, 622, 623, similarly configured to provide a cement board product substantially equal in size and shape.

[0041] According to various embodiments, base support panel 620 can include a fiberglass reinforced plastic panel 624. Such a fiberglass reinforced plastic panel allows for cement to be deposited on the panel and provide adequate resilience in supporting the fabrication of the layered cement board. Advantageously, the fiberglass reinforced plastic panel provides for a fiberglass surface which is alkaline resistant, and does not react to the cement deposited on its surface, and which is compressed onto it. In embodiments, the support panel includes a sandwich panel, in which two panels of fiberglass reinforced plastic 624, 626, is provided about a support structure 628. In embodiments, the support structure includes a geometrically stable structure in the sandwich panel. In embodiments, the support structure can include any one of a triangular or truss structure, a hexagonal or honeycomb structure, a quadrilateral or rectangular or diamond structure, or any other polygonal structure which adequately provides structural reinforcement for the sandwich panel. Having such an intermediate support structure greatly increases the resilience of the base support panel, in providing a counter-force to the compressing rollers, or in receiving and supporting the layered cement board during the curing process, where it would be of pertinent importance that the base support panel maintains its flat upper surface in preventing warping of the layered cement board during curing. According to various embodiments, the sandwich panel

can include epoxy resin as an adhesive to keep various components such as the fiberglass reinforced plastic panels coupled to the support structure.

[0042] System 600 further includes a cement deposit device 630. Cement deposit device 630 can be a valve-controlled delivery system for depositing cement onto the base support panel 620 on the system 600. Cement deposit device 630 can be coupled to a cement mixing apparatus, which can carry out the mixing of a cement mixture. Such a cement mixing apparatus can include a drum with a plurality of mixing arms extending from a central pillar, the arms rotatable with respect to the drum. Within the drum, a mixture of cement can be aggregated, and can include materials such as fly ash, slag, chalk, slate, silica sand and/or iron ore, mixed together with water to form a paste. It can be noted that as water is added to the cement mixture, calcium hydroxide can be formed, which can be considered highly alkaline. Such a factor thus requires care in handling wet cement.

[0043] In various embodiments, an additive can be included in the cement mixture. Such an additive is introduced to provide a stronger bonding effect between a cement layer and a fabric layer in the layered cement board according to various embodiments. Such improved bonding between the cement and fabric layer is important in the layered cement board to ensure that the layers adhere together without deterioration over time.

[0044] In various embodiments, starch ether can be added to the cement mixture. Starch ethers can be understood to be a by-product from potato and/or maize starch, for example with propylene oxide. Starch ethers have previously been provided for use in mortar applications and typically introduce unique physical features to the cement or mortar mixture. Such features are typically, improved workability, reduced stickiness, and improved sag resistance. Surprisingly, the present inventors have discovered that introducing starch ethers into the cement mixture, instead of reducing stickiness and adhesion with the fabric layer,

improves the bonding between cement and fabric, and adds to the durability of the layered cement board.

[0045] Further, water reducers can also be introduced into the cement mixture to reduce water content in the mixture and to also provide several advantageous features to the cement characteristics, for example, increased cement layer strength, decreased porosity, reduced water permeability, and even provide a better finish to the cement.

[0046] Cement deposit device 630 can include a downward facing nozzle 632, which can be controlled by a valve to release the mixed cement paste 634. The valve can be electronically controlled by a manufacturing control system or through manual means. When the paste 634 gets deposited onto the base support panel 620, at typically a fixed point directly below the nozzle 632, the cement paste 634 can be smoothened onto the breadth of the support panel 620. Smoothening can be done with a mechanically actuated arm (not shown) sweeping above the surface of the support panel 620, or can be done manually.

[0047] As the constantly actuating conveyor belt system 610 moves the base panel 620 through the system 600, the deposited cement paste 634 is transported further down the system 600. A fiberglass mesh layer 636 is thereafter introduced into the deposited cement paste 634. Thereafter, the fiberglass mesh layer 636 and the deposited cement 634 are delivered under a roller 638 by the conveyor belt 610. The roller 638 is provided at a predetermined clearance height from the base panel 620. The motion under the roller 638 provided by the conveyor belt 610, in bringing the cement in between the roller 638 and the panel 620, creates a compression effect on the deposited cement 634 to form a first cement layer 640. First cement layer 640 can also include the interlaid mesh layer 636. In embodiments, the roller is a freewheeling roller. In various embodiments the roller is a mechanically actuated roller. In embodiments, the roller is provided at a clearance height in a range from about 2mm to about 12mm. In embodiments, the roller is provided at a clearance

that, with respect to the amount of deposited and smoothed cement, does not create a compression effect on the deposited cement paste.

[0048] Fiberglass mesh layer 636 can include a criss-cross arrangement or web with a plurality of apertures. The mesh layer 636 thus can sink into and become part of first cement layer 640. System 600 can further include where a fabric layer 642 is provided on the first cement layer 640. Fabric layer 642 can be a polymeric fabric overlaid as a layer in the formation of the layered cement board. According to various embodiments, the polymeric fabric layer is provided with a property of being substantially chemically inert in an alkaline environment of about 10-12 pH. In embodiments, the polymeric fabric layer can include any one a polyolefin fabric layer, a thermoplastic polymer fabric layer or a polyamide fabric layer. In embodiments, the polymeric fabric layer can include any one of a polyethylene fabric layer, a polypropylene fabric layer, a polymethylpentene fabric layer or a polybutene fabric layer, a polytetrafluoroethylene fabric layer, a polyvinyl chloride fabric layer or an acrylic fabric layer. According to embodiments, such a polymeric fabric layer is provided to retain purposefully separating cement layers in the layered cement board, and remain chemically inert to any acid or base reactions.

[0049] Roller 644 is provided to direct fabric layer 642 onto the first cement layer 640. First cement layer 640 and the overlaid fabric layer 642 are delivered under roller 644 by the conveyor belt. Roller 644 is provided at a predetermined clearance height from the base panel 620. A compression effect by roller 644 on the first cement layer 640 and the first fabric layer 642 incorporates both layers together and further provides a compact interim portion of the layered cement board. In embodiments, the roller is provided at a clearance height of a range from about 2mm to about 12mm. In embodiments, the system 600 can operate with only roller 644 provided after the first fabric layer 642 is overlaid, and does not include an interim roller 638 provided after the fiberglass mesh layer 636 is laid. Such an arrangement can be

advantageous as performing a high stress compression effect directly on cement can lead to the cement mix not setting adequately or compactly, which can be detrimental to the fabrication of the layered cement board.

[0050] System 600 thereafter conveys the compacted first cement layer 640 and first fabric layer 642 forward, and a second cement deposit device 650 is provided, the second cement deposit coupled to a second cement mixing apparatus. In embodiments, the system can include a single cement mixing apparatus, coupled the various cement deposit devices in the system, providing for a single efficient mixing process and apparatus. Cement deposit device 650 can include a downward facing nozzle 651, which can be controlled by a valve to release mixed cement paste 652. Cement paste 652 can be the same cement paste mix as provided in any other cement layer of the layered cement board, or various cement layers can include certain additives in the cement mix, to provide for additional properties in the particular cement layer. Similarly, smoothening can be carried out when the cement mix 652 is deposited.

[0051] A second fabric layer 656 can further be provided onto the deposited cement paste 652. The second fabric layer 656 can be directed onto the cement paste 652 with a roller 658. Roller 658 is provided at a predetermined clearance height from the base panel 620, the clearance height being slightly greater than the clearance height setting of the previous roller 644. A compression effect by roller 658 on the deposited cement 652 and the second fabric layer 656 incorporates both layers together and further provides a compact interim portion of the layered cement board. The deposited cement 652 forms a second cement layer 654 in view of the compression effect of the roller 658. In embodiments, a fiberglass mesh layer can also be provided on or in the second cement layer 654, prior to the overlaying of the second fabric layer 656.

[0052] A third cement deposit device 660 can be provided, further down the conveyor belt system 610. Cement deposit device 660 further includes a valve-controllable nozzle 662, configured to release cement paste 664. Cement paste mix 664 is deposited on the overlaid and compacted second fabric layer 656. Deposited cement 664 can be smoothened over the overlaid second fabric layer 656, which allows for subsequent formation of third cement layer 666 when put through a compression process.

[0053] A fiberglass mesh layer 668 can be introduced onto the deposited cement mix 664. Fiberglass mesh layer 668 and the cement mix 664 are delivered under roller 670 by conveyor belt 610. Roller 670 can be provided for carrying out a compression of the deposited cement mix 664 with the fiberglass mesh layer 668 retained within. In embodiments, roller 670 is provided to simply direct fiberglass mesh layer 668 onto the deposited cement mix 664.

[0054] A third fabric layer 672 can further be provided onto the deposited cement paste 664. The third fabric layer 672 can be directed onto the cement paste 664 with a roller 674. Roller 674 is provided at a predetermined clearance height from the base panel 620, the clearance height being slightly greater than the clearance height setting of the previous roller 658. A compression effect by roller 674 on the deposited cement 664 and the third fabric layer 656 incorporates both layers together with the already overlaid cement and fabric layers, and further provides a compact formation of the layered cement board. The deposited cement 664 can form a third cement layer 666 in view of the compression effect of the roller 674. In embodiments, the roller is provided at a clearance height of a range from about 7mm to about 25mm. According to various embodiments, system 600 is configured to provide three layers of cement and three fabric layers in a layered cement board, and compression carried out by roller 674 can indicate the end of the fabrication or manufacturing process which includes overlaying various layers.

[0055] System 600 can include an elongate portion 680 after the final roller 674. Such an elongate portion 680 allows for the overlaid cement and fabric layers 676 to enter a curing process, in which moisture in the cement mixture is intended to be removed, and the cement hardened. Elongate portion 680 can be anywhere in a range from 20 meters to about 100 meters, perhaps about 75 meters. Along the elongate portion 680 can be introduced overhanging lamps 682 which can be directed to provide heat over the cement board to be dried. Such heat lamps serve to expedite moisture extraction through evaporation.

[0056] A separator 682 is provided along the elongated portion, the separator 682 configured to provide a separation in the overlaid cement and fabric layers 676 to independent layered cement boards. Separator 682 can include a knife edge, suitable for cutting through the cement and fabric combination 676 smoothly, and without befouling the cement and fabric layered arrangement. Separator 682 can be arranged to slice through the cement and fabric combination 676 at a separation between base panels 620, thereby providing for the cement and fabric combination 676 to be cured separately with respect to individual base panels 620. This further allows the base panels to be separately handled in the curing process. In separating the cement and fabric combination, a layered cement board 686 can be obtained.

[0057] In embodiments, the layered cement board 686 can be further cured apart from the conveyor belt system 610. According to various embodiments, the separated layered cement board 686 upon a base support panel can be entirely uplifted to a separate location for further curing. The layered cement board 686 can be placed onto a rack structure (not shown) capable of receiving a plurality of layered cement boards resting on respective base support panels, the boards arranged in parallel. Further, the layered cement boards for drying can be arranged in close proximity to each other, allowing for maximization of space and

convenience. Further, the close proximity also allows for a uniformity of process quality in the curing process. In various embodiments, the rack structure can be removed.

[0058] In embodiments, the curing process can be carried in an environment with lowered humidity and raised temperature to allow for quicker evaporation or removal of moisture from the cement layers in the layered cement board. Further, the pressure in the environment can be reduced to improve evaporation. Fans can also be provided to raise air circulation about the drying panels. Providing such an environment allows for the hastening of the removal of moisture and allows the layered cement board to be ready for application more quickly, providing a shorter turn-around time.

[0059] In various embodiments, the curing process can be carried out under room temperature and pressure or standard ambient temperature and pressure. As indicated above, providing a specialized environment for the curing process can be preferred to provide a quicker curing process. However, such environments can be costly with respect to manufacturing. In situations where manufacturing turn-around time is not of concern, the layered cement boards can simply be left to dry on its own. As mentioned above, in various embodiments, an additive can be added into the cement mixture. In embodiments, a water reducer can be added to the cement mixture. The water reducer lowers the water content in the cement mixture, which can result in a shorter curing process after the cement and fabric layers are deposited.

[0060] In carrying out the curing process, the intended outcome is to have a layered cement board that is without deformation, which can arise during the curing process. As such, the base support panel is of high importance, in providing a resilience against deformation of the base support panel as well as the drying layered cement board. During the curing process, it has been observed by the present inventors that the drying cement board generates heat, which correlates to the enthalpy of vaporization or latent heat of evaporation. The base

support panel is thus designed to ensure that its surface does not warp or deform in the event of such heat generation, which can thus lead to a relatively unblemished layered cement board end-product.

[0061] Further, in various embodiments, there can be variations in the manufacturing method with respect to the curing of the layered cement board. This may in view of a careful decision which is required with regard to the time of curing. As may be known, when the cement is wet, it is highly alkaline in nature, but when dry, is chemically inert. It may thus be desired that the cement board is cured rapidly to bring the cement mixture into a chemically inert state. However, curing the cement board too quickly can cause warp-age in the formation of the cement board. In various embodiments, it is sought to overcome the alkalinity of the cement in providing a more effective fabric layer. Such a provision allows for a longer curing time to be carried out. Nevertheless, various embodiments of the present disclosure also present solutions to overcome various limitations with regard to curing time and layered cement board formation strength.

[0062] In various embodiments, there is provided a layered cement board including a plurality of polymeric fabric layers; and a plurality of cement layers, the plurality of polymeric fabric layers being interlaid between the plurality of cement layers; wherein the plurality of polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14 pH.

[0063] In embodiments, the plurality of polymeric fabric layers comprise any one of a polyolefin fabric layer, a thermoplastic polymer fabric layer, or a polyamide fabric layer.

[0064] In embodiments, the plurality of polymeric fabric layers comprise any one of a polypropylene fabric layer, a polyethylene fabric layer, a polytetrafluoroethylene fabric layer, a polyvinyl chloride fabric layer or an acrylic fabric layer.

[0065] In embodiments, the layered cement board further includes at least two cement layers.

[0066] In embodiments, the layered cement board further includes at least two polymeric fabric layers.

[0067] In embodiments, the layered cement board further includes three polymeric fabric layers being interlaid between three cement layers.

[0068] In embodiments, the layered cement board further includes fiber mesh layer provided in any one of the cement layers and between an overlaid polymeric fabric layer.

[0069] In embodiments, the layered cement board further includes two fiber mesh layers, one provided in a top-most cement layer of the layered cement board, and another in a bottom-most cement layer of the layered cement board.

[0070] In various embodiments, there is provided a method of manufacturing a layered cement board, including: providing a base panel; depositing a first layer of cement on the base panel, the first layer of cement arranged to be vertically deposited onto the base panel; overlaying the first layer of cement with a first polymeric fabric layer; depositing a second layer of cement on the first polymeric fabric layer and overlaying the second layer of cement with a second polymeric fabric layer; and compressing the interlaid layers of cement and polymeric fabric on the base panel with a set of rollers; wherein the polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14.

[0071] In embodiments, the method further includes depositing a third layer of cement on the second polymeric fabric layer and overlaying the third layer of cement with a third polymeric fabric layer.

[0072] In embodiments, the method further includes overlaying the first layer of cement with a fiber mesh layer prior to overlaying the first layer of cement with the first polymeric fabric layer.

[0073] In embodiments, the method further includes overlaying the third layer of cement with a fiber mesh layer prior to overlaying the third layer of cement with the third polymeric fabric layer.

[0074] In embodiments, the method further includes compressing the interlaid layers of cement and polymeric fabric on the base panel with a set of rollers to provide an output thickness determined in the range of 7 to 25 mm.

[0075] In embodiments, the method further includes compressing the first layer of cement and the first polymeric fabric layer with a first set of rollers to provide an output thickness determined in the range of 2 to 12 mm.

[0076] In embodiments, the method further includes introducing a starch ether additive to a cement mixture for providing any layer of cement, the second layer of cement, or the third layer of cement in the layered cement board.

[0077] In embodiments, the base panel comprises a fiberglass reinforced plastic panel.

[0078] In embodiments, the base panel comprises a fiberglass reinforced plastic sandwich panel.

[0079] In embodiments, the sandwich panel comprises two panels of fiberglass reinforced plastic provided about a support structure.

[0080] In embodiments, the support structure comprises a honeycomb structure.

[0081] In embodiments, the method further includes carrying out a curing of the overlaid layers of cement and polymeric fabric to remove moisture from the prepared cement block.

[0082] In embodiments, the method further includes curing the overlaid layers of cement and polymeric fabric under standard ambient temperature and pressure.

[0083] The above apparatus, method and/or system as described and illustrated in the corresponding figures, is not intended to limit an or any apparatus, method or system as according to an embodiment, and the scope of the present disclosure. The description further

includes, either explicitly or implicitly, various features and advantages of the method or system according to the present disclosure, which can be encompassed within an apparatus, method or system according to the disclosure.

[0084] While embodiments of the disclosure have been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the disclosure as defined by the appended claims. The scope of the disclosure is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

What is claimed is:

1. A layered cement board comprising:
a plurality of polymeric fabric layers comprising a first polymeric fabric layer and a second polymeric fabric layer; and
a plurality of cement layers comprising a first cement layer and a second cement layer,
wherein the first polymeric fabric layer is interlaid between the first cement layer and the second cement layer, and the second polymeric fabric layer is disposed on the second cement layer,
wherein the first polymeric fabric layer and the first cement layer are compressed together to form first compressed layers, and the second polymeric fabric layer and the second cement layer are compressed together to form second compressed layers on the first compressed layers, and
wherein the plurality of polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14 pH.
2. The layered cement board of claim 1, wherein the plurality of polymeric fabric layers comprise any one of a polyolefin fabric layer, a thermoplastic polymer fabric layer, or a polyamide fabric layer.
3. The layered cement board of claim 1 or 2, wherein the plurality of polymeric fabric layers comprise any one of a polypropylene fabric layer, a polyethylene fabric layer, a polytetrafluoroethylene fabric layer, a polyvinyl chloride fabric layer or an acrylic fabric layer.
4. The layered cement board of any one of the preceding claims, further comprising a third cement layer.
5. The layered cement board of claim 4, further comprising a third polymeric fabric layer.

6. The layered cement board of claim 5, wherein the second polymeric fabric layer is interlaid between the second cement layer and the third cement layer.
7. The layered cement board of any one of the preceding claims, further comprising a mesh layer provided in or on one of the cement layers and under a corresponding one of the plurality of polymeric fabric layers disposed on said one of the cement layers.
8. The layered cement board of any one of claims 1 to 6, further comprising a first mesh layer provided in or on the first cement layer and under the first polymeric fabric layer, and a second mesh layer provided in or on the third cement layer and under the third polymeric fabric layer.
9. A method of manufacturing a layered cement board, comprising:
 - providing a base panel;
 - depositing a first layer of cement on the base panel, the first layer of cement arranged to be vertically deposited onto the base panel;
 - overlaying the first layer of cement with a first polymeric fabric layer;
 - compressing the first layer of cement and the first polymeric fabric layer together with a first set of rollers to form first compressed layers;
 - depositing a second layer of cement on the first compressed layers and overlaying the second layer of cement with a second polymeric fabric layer; and
 - compressing the second layer of cement and the second polymeric fabric layer together with a second set of rollers to form second compressed layers on the first compressed layers;wherein the polymeric fabric layers are substantially chemically inert in an alkaline environment of about 12-14 pH.
10. The method of claim 9, further comprising:
 - depositing a third layer of cement on the second compressed layers and overlaying the third layer of cement with a third polymeric fabric layer.
11. The method of claim 9 or 10, further comprising: overlaying the first layer of cement with a mesh layer prior to overlaying the first layer of cement with the first polymeric fabric layer.

12. The method of claim 10, further comprising: overlaying the third layer of cement with a mesh layer prior to overlaying the third layer of cement with the third polymeric fabric layer.
13. The method of any one of claims 9 to 12, wherein the compressed layers on the base panel are compressed to together provide an output thickness in the range of 7 to 25 mm.
14. The method of any one of claims 9 to 12, wherein the first compressed layers are compressed to provide an output thickness in the range of 2 to 12 mm.
15. The method of any one of claims 9 to 14, further comprising introducing a starch ether additive to a cement mixture for providing the first layer of cement, the second layer of cement, and/or the third layer of cement in the layered cement board.
16. The method of any one of claims 9 to 15, wherein the base panel comprises a fiberglass reinforced plastic panel.
17. The method of claim 16, wherein the fiberglass reinforced plastic panel is a fiberglass reinforced plastic sandwich panel.
18. The method of claim 17, wherein the fiberglass reinforced plastic sandwich panel comprises two panels of fiberglass reinforced plastic provided about a support structure.
19. The method of claim 18, wherein the support structure comprises a honeycomb structure.
20. The method of any one of claims 9 to 19, further comprising carrying out a curing of the compressed layers to remove moisture therefrom.
21. The method according to claim 20, wherein the curing of the compressed layers is performed under standard ambient temperature and pressure.