

POLYESTER LAMINATED BUILDING BOARDS WITH IMPROVED SURFACE CHARACTERISTICS

TECHNICAL FIELD

[0001] This disclosure relates to the use of polyester laminates in building boards. More particularly, the present disclosure relates to using polyester laminates to improve the surface characteristics of building boards.

BACKGROUND OF THE INVENTION

[0002] For over a century, wallboard has been used as an interior wall covering. The most common type of wallboard is gypsum wallboard. The basic construction includes a core of cementitious gypsum that is positioned between two opposing paper liners. One of the paper liners forms the exterior wall finishing. An example of a paper-covered gypsum board is illustrated in U.S. Pat. No. 2,806,811 to Von Hazmburg. Von Hazmburg discloses a board that primarily consists of a thick gypsum core that is encased in a fibrous envelope consisting of both a manila sheet and a newsprint sheet. These sheet layers can be made from a conventional multi-cylinder paper making process.

[0003] It is also known to replace the paper facing sheets with opposing glass fiber mats. This construction is referred to as glass reinforced gypsum boards (or "GRG"). A GRG board is disclosed in U.S. Pat. No. 4,265,979 to Baehr et. al. A further improvement was realized by slightly embedding one or more of the glass fiber mats into the core slurry of the board during the manufacturing process. This results in a thin film of slurry being formed on the outer surface of the board. Building boards with this construction are referred to as embedded glass reinforced gypsum (EGRG) boards. EGRG boards eliminate, or greatly reduce, the presence of exposed fibers.

[0004] Yet, paper faced boards, GRG boards, and EGRG boards, all require extensive finishing materials and labor intensive steps in order to achieve a desirable exterior wall finishing. According to the Gypsum Association, wall finishings are measured on a scale ranging from the least smooth (Level 0) to the most smooth (Level 5). A level 0, the exterior surface of the board is rough and or textured in appearance.

Contortions and undulations are easily visible upon the board. At Level 5, the exterior surface of the board has a very smooth appearance that approximates glass.

[0005] Paper faced gypsum board is not capable of yielding a Level 5 finish without the incorporation of special sealers and multiple skim coats of a finishing compound. Sanding is also required as each level is built up. Hence, achieving a Level 5 finish with paper faced boards is a labor intensive process that requires a variety of added materials.

[0006] Forming a Level 5 finish on GRG or EGRG boards can prove equally problematic albeit for different reasons. GRG and EGRG boards have a cementitious surface and/or core that is filled with desiccant-like materials. Thus, when finishing compounds are added to the surface of these boards, they are quickly absorbed. To be effective, large volumes of finishing compounds must be used. The absorption of the finishing compounds can also cause voids, cracking, premature desaturation and resultant quick set. All of these precludes the formation of a Level 5 finish on GRG or EGRG boards.

[0007] Various efforts have been made over the years to reduce the materials, labor, and time needed to adequately finish the exterior surface wall boards. For example, sprayable compounds have been developed to provide wall boards with Level 4 or Level 5 finishes. Yet, these sprayable compounds suffer from all of the aforementioned drawbacks. Paper faced boards do not saturate quickly enough. As a result, sprayable finishes run when applied to paper faced boards. By contrast, glass reinforced boards absorb liquids too quickly. As a result, unnecessarily large volumes of spray must be used in order to achieve a desired finish. These problems can only be overcome by using skim coatings or specialized primers, which only adds to the time and expense of the finishing effort.

[0008] The composite building boards of the present disclosure are designed to overcome these drawbacks by utilizing a polyester film to achieve a smooth exterior finish with minimal finishing materials, time or expense.

SUMMARY OF THE INVENTION

[0009] This disclosure permits smooth exterior finishes to be applied to wall boards with minimal finishing materials, time, and expense.

[0010] One advantage of the present disclosure is realized by utilizing a polyester laminate to produce a wall board having a smooth exterior finish.

[0011] Yet another advantage is attained by employing a polyester laminate as the base for an exterior acrylic coating, which itself provides a satisfactory surface.

[0012] Still yet another advantage is achieved by adhering a polyester film to a fibrous mat via a hot melt adhesive, thereby producing a laminate that can facilitate the formation of smooth exterior surface.

[0013] Another advantage is reached by adhering an acrylic lined polyester film to a fibrous mat via a hot melt adhesive, thereby producing a laminate that provides a smooth exterior surface.

[0014] A further advantage is realized by using a perforated polyester film in the creating of a building board with a desirable surface finishing.

[0015] The building boards of the present disclosure enable the formation of Level 5 finishes without the need for extra finishing materials and while minimizing time, labor, and expense.

[0016] Various embodiments of the invention may have none, some, or all of these advantages. Other technical advantages of the present invention will be readily apparent to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] For a more complete understanding of the present disclosure and its advantages, reference is now made to the following descriptions, taken in conjunction with the accompanying drawings, in which:

[0018] FIG. 1 is a cross sectional view of a building board made in accordance with the present disclosure.

[0019] FIG. 2 is a side elevational view of a production line for producing building boards in accordance with the present disclosure.

[0020] FIG. 3 is detailed view of the production line taken from FIG. 2.

[0021] FIG. 4 is a side elevational view of an alternative production line for producing building boards in accordance with the present disclosure.

[0022] FIG. 5 is a detailed view of the production line taken from FIG. 4.

[0023] FIG. 6 is a sectional view taken from Line 6-6 of FIG. 3.

[0024] FIG. 7 is a sectional view taken from Line 7-7 of FIG. 5.

[0025] Similar reference characters refer to similar components throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE DRAWINGS

[0026] The present disclosure relates to the use of polyester films to facilitate improved surface finishings for building boards. The polyester film is preferably applied to a glass mat via an adhesive to form a mat/film laminate. The laminate is subsequently bonded to the surface of a gypsum board. The polyester film is advantageous because it allows for exterior surface coatings to be applied. In one embodiment, an exterior acrylic coating is applied to the polyester film. Boards constructed in accordance with this disclosure allow for exterior finishings to be achieved without the need for excessive finishing materials or steps.

[0027] With reference to FIG. 1, polyester film **22** forms one layer of to a composite, multi-layered building panel **24**. Panel **24** can be formed from opposing paper sheets with an interior gypsum core **26**. In another embodiment, opposing fibrous mats **28** are used in lieu of paper sheets. Fibrous mats **28** are formed from randomly aligned organic or inorganic fibers that are held together with a binder. As with conventional EGRG boards, mats **28** are porous to allow mat **28** to be slightly embedded in the gypsum core **26** during assembly. It is also within the scope of the present invention to utilize gypsum fiber boards.

[0028] Core **26** is formed from a set, crystalline gypsum matrix that extends fully between, and is bonded to, the interior surfaces of the upper and lower fiber mats **28**. In one specific but non-limiting example, the portion of core **26** proximate upper and lower fiber mats **28** has a density that is greater than the density of the remainder of core **26**. In other words, the inner most extent of core **26** is less dense than the upper

and lower peripheries. This helps strengthen the face of the board without unduly increasing the overall board weight.

[0029] Core 26 may optionally include high levels of fiber and starch. The fibers can be glass fibers, wood fibers, fibers derived from wood, synthetic polymer fibers, or agglomerations of paper and wood fibers. In a preferred but non-limiting example, the fibers may comprise more than about 1% of the board weight. The starch may likewise may comprise more than about 1% of the board weight. Optionally the starch may be partially or completely replaced by a synthetic polymer.

[0030] If glass fibers are used, they may include lengths of approximately 3 to 50 millimeters (mm) with widths of 5 to 80 micrometers (μ). If derived wood fibers are utilized, they can be formed from regenerated cellulose fibers having an average length between about 0.1mm to 0.5mm with a width less than 20 micrometers (μ). The longest dimension of the fiber agglomerations would be about 1mm to 15mm.

[0031] The preferred starches may be migratory or non-migratory, including , native, acid thinned, oxidized, substituted (e.g. cationic starches, ethylated starches) or dextrinized. The preferred synthetic polymers would include polyvinyl acetate, polyvinyl acetate-ethylene co-polymer, polyvinyl pyrrolidone cross-linked with polystyrene sulfonate, polyvinyl alcohol, methyl cellulose, hydroxyethyl methyl cellulose, styrene-butadiene copolymer latex, acrylic ester latex, acrylic copolymer latex, polyester resin, epoxy resin, polymethyl methacrylate, or polyacrylic acid.

[0032] In the preferred embodiment, polyester film **22** is formed from polyethylene terephthalate (PET). However, the use of other polyester films is also within the scope of the present invention. It is also within the scope of the present invention to employ polymer films such as, but not limited to, polyethylene, polypropylene, polystyrene, polyurethane, polyvinyl acetate, or polyvinyl alcohol films. The interior surface of film **22** can be modified to improve its ability to adhere to lower layers and to promote the formation of a laminate. For example, the interior surface can be modified via corona or flame treatments.

[0033] An adhesive **32** is employed in adhering polyester film **22** to the exterior surface of the upper mat **28**. The preferred adhesive is a hot melt polymer adhesive. The adhesive may be heat activated. Other polymer based resins can likewise be used.

The adhesive composition may include additives for ultraviolet (UV) resistance, antimicrobial resistance, or other additives to promote adhesion. A nip or roller can be used to activate adhesive **32** and thereby join film **22** to the exterior surface of the upper mat **28**. This step can be carried out prior to, and separate from, the other steps needed to produce the final composite board **24**. Alternatively, film **22** and mat **28** can be joined together at a point along the board forming station **44** (note FIG. 2). Upper mat **28** with the adhered polyester film **22** together form a laminate sheet **42**. Adhesive **32** forms an outer stratum on fibrous mat **28** that is smooth and that is substantially free of the fibers that make up mat **28**. As a result, film **22** produces a smooth outer application surface that is level in appearance. Film **22**, thereby, presents an excellent surface for subsequent finishing materials, such as acrylics or similar materials. In practice, the exterior surface of film **22** may consist of minor topographical inconsistencies ranging from a minimum depth of .001 inches to a maximum of about 0.01 inches. In one possible alternative, film **22** can have an adhesive applied to both of its outer surfaces such that film **22** can be bonded to multiple different layers.

[0034] A finish coating **34** is thereafter applied to the exposed surface of film **22**. In the preferred embodiment, finish coating **34** is an acrylic. Acrylic coating **34** is applied to the surface of the polyester film **22** to give board **24** a smooth exterior surface finish. Acrylic coating **34** also beneficial because it provides paint adhesion and a matte finish. In an alternative embodiment, the acrylic coating **34** may be adhered to the film **22** and mat **28** prior to laminate being delivered to the board forming line **44**.

[0035] Perforations can be formed in film **22** and/or in mat **28** to avoid blistering during the subsequent drying of board **24**. This can be accomplished by perforating film **22** prior to it being adhered to mat **28**. Alternatively, the mat **28** and film **22** can be perforated together after formation of the laminate. In either case, the perforations allow for the transmission of vapor, including but not limited to water vapor, during the subsequent drying of composite board **24**. More specifically, as the board passes through one or more driers, water vapor is liberated from the partially or fully hydrated gypsum. Without the perforations, the water vapor that is driven out of the core **26** may cause blistering or deformation of the upper paper or fibrous mat.

[0036] FIG. 2 illustrates one possible manufacturing process for producing building board in accordance with the present disclosure. Mat **28** is unwound from a supply roll (not shown) and brought into contact with film **22**. Mat **28** and film **22** are brought together between a nip roll **38** and a chill roll **36**. A die supplies adhesive **32** to the nip as the mat **28** and film **22** are brought together. Adhesive **32** bonds film **22** to an exterior surface of mat **28**. Together mat **28** and film **22** form a laminate **42** that is subsequently delivered to production line **44**. Gypsum slurry is then supplied to the surface of the mat **28** that is opposite the adhered film **22**. The gypsum slurry is delivered from a mixer **46**. The film/mat laminate **42** is preferably embedded into the deposited slurry. Vibrators can be included to ensure a sufficient degree of penetration. The degree of penetration can range from 0.5% to 101%. Namely, the deposited slurry can penetrate between 0.5% to 101% of thickness of the laminate **42**. An additional supply of a fibrous mat **28** can be delivered from supply roll **48** to form the opposite side of the building board. FIG. 3 is a more detailed view of the nip roll **38** and chill roll **36**. The cross section of FIG. 6 also shows the resulting laminate **42**. Specifically, laminate **42** is formed from fibrous mat **28**, adhesive **32** and film **22**.

[0037] It is within the scope of the present disclosure to apply both adhesive **32** and film **22** in liquefied form as a co-extrusion. Film **22** can be applied to mat **28** prior to arriving at the production line **44**. Alternatively, as depicted in FIG. 2, film **22** and mat **28** can be adhered as part of a single manufacturing process. Film **22** can similarly be adhered at a point downstream of the production line **44**. For instance, film **22** can be applied pre or post dryer. Film **22** can be chemically pre-conditioned to chemically bond with compounds, softening agents, acids, alkalizers, waxes, or combinations thereof, within adhesive **32**. This chemical bonding improves the mechanical and/or chemical adhesion between the film and adhesive **32**.

[0038] FIGS. 4 and 5 illustrate an alternative manufacturing process. This process is the same in most respects to the above reference process. However, following the formation of the mat **28** and film **22** laminate, an acrylic coating **34** is applied overtop of film **22**. FIG. 7 is a cross sectional view of the resulting laminate, which consists of mat **28**, adhesive **32**, film **22**, and acrylic coating **34**.

[0039] Although this disclosure has been described in terms of certain embodiments and generally associated methods, alterations and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure.

WHAT IS CLAIMED IS:

1. A composite, multi-layered building panel comprising:
 - opposed upper and lower fiber mats, the mats being porous and each mat having an interior and an exterior surface;
 - a set gypsum core extending between and bonded to the interior surfaces of the upper and lower fiber mats, the portion of the set gypsum core proximate the upper and lower fiber mats having a density that is greater than the remainder of the set gypsum core;
 - a polyethylene terephthalate (PET) film having an interior and an exterior surface, the interior surface being modified via a corona treatment to improve bonding;
 - a hot melt polymer adhesive adhering the modified interior surface of the PET film to the exterior surface of the upper mat, whereby the PET film is bonded to the upper fiber mat;
 - an acrylic coating applied to the exterior surface of the PET film, the acrylic coating providing a surface finish to the composite, multi-layered building panel.
2. A building panel comprising:
 - at least one mat having an interior and an exterior surface;
 - a set core bonded to the interior surface of the mat;
 - a polyester film having an interior and an exterior surface;
 - an adhesive adhering the interior surface of the polyester film to the exterior surface of the mat, whereby the polyester film is bonded to the upper fiber mat.
3. The building panel as described in Claim 2 wherein the building panel comprises upper and lower mats that are each formed from randomly aligned inorganic fibers held together by a binder.
4. The building panel as described in Claim 2 wherein the portion of the set core proximate the mat has a density that is greater than the remainder of the set gypsum core.

5. The building panel as described in Claim 2 wherein the interior surface of the polyester film is modified to improve adhesive bonding.

6. The building panel as described in Claim 5 wherein the interior surface of the polyester film is modified via a corona treatment

7. The building panel as described in Claim 5 wherein the interior surface of the polyester film is modified via a flame treatment.

8. The building panel as described in Claim 2 wherein the adhesive is a hot melt polymer adhesive.

9. The building panel as described in Claim 2 further comprising an acrylic coating applied to the exterior surface of the polyester film, the acrylic coating providing a surface finish to the building panel.

10. The building panel as described in Claim 2 wherein the polyester film is a polyethylene terephthalate (PET) film.

11. The building panel as described in Claim 2 wherein the polyester film is perforated.

12. A building panel comprising:
a laminate comprising a perforated polyester film bound to a sheet;
a core of set gypsum;
the laminate embedded within the set gypsum core.

13. The building panel as described in Claim 12 wherein both the polyester film and the sheet are perforated.

14. The building panel as described in Claim 12 wherein the polyester film is a polyethylene terephthalate (PET) film.

15. The building panel as described in Claim 12 further comprising an acrylic coating applied to the exterior surface of the polyester film, the acrylic coating providing a surface finish to the building panel.

16. The building panel as described in Claim 12 further comprising a pressure sensitive adhesive for use in bonding the polyester film to the sheet.

17. The building panel as described in Claim 12 wherein the sheet comprises a paper lining.

18. The building panel as described in Claim 12 wherein the sheet comprises a mat of fibers held together by a binder.

19. The building panel as described in Claim 12 wherein the degree to which the laminate is embedded within the gypsum is between approximately 0.5% to 101% of the overall thickness of the laminate.

20. The building panel as described in Claim 2 wherein the core includes high levels of fiber and starch.

21. The building panel as described in Claim 20 wherein the fibers comprise more than 1% of the core weight.

22. The building panel as described in Claim 20 wherein the starch comprises more than 1% of the core weight.

23. The building panel as describe in Claim 20 wherein a synthetic polymer is used in lieu of the starch.

24. The building panel as described in Claim 2 wherein the core comprises set gypsum.