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(54) **PREFABRICATED ROOFING PANEL COMPOSITE**

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(57) **ABSTRACT**

A prefabricated roofing panel composite includes a prefabricated cover board having a high-density polymer or predominantly polymer material core layer having a density between 6 lbs/ft^3 and 25 lbs/ft^3 and an insulation board that has a low-density polymer or predominantly polymer material foam core layer having a density less than or equal to about 2 lbs/ft^3. The cover board may have a waterproofing membrane forming the top major surface of the cover board. The low-density foam core layer of the insulation board may be formed with the high-density core layer of the cover board being currently or subsequently formed over and bonded to a top major surface of the low-density foam core layer in the same operation or preformed insulation boards may be fed into a production line with the high-density core layer of the cover board being formed over and bonded to top major surfaces of the low-density foam core layers of the insulation boards.

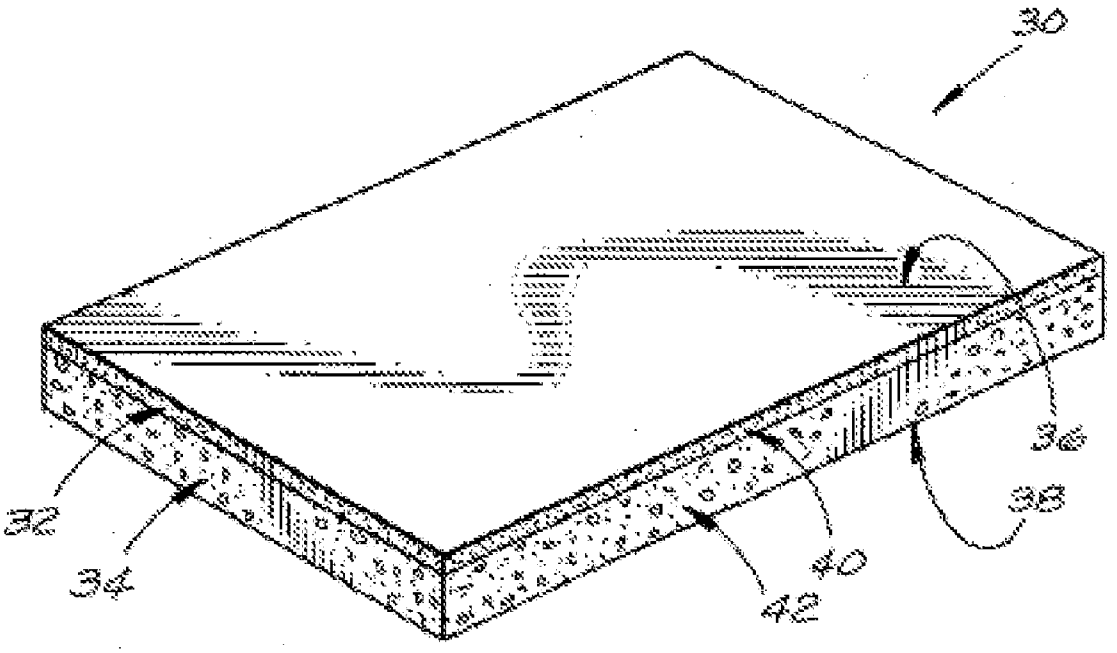


FIG. 1

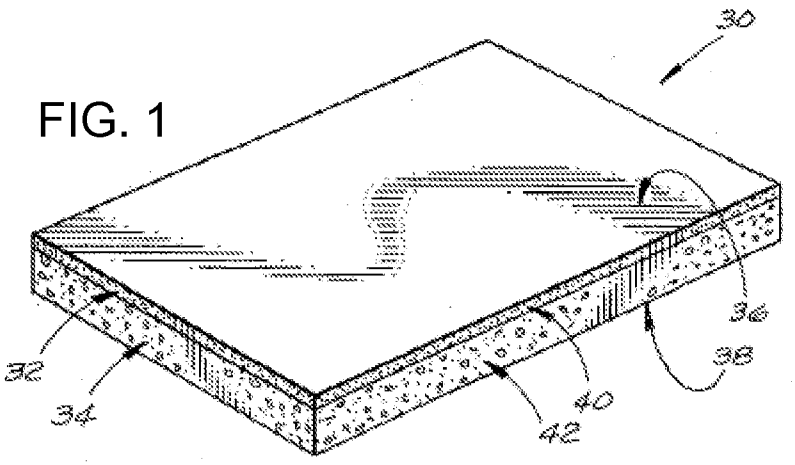


FIG. 2

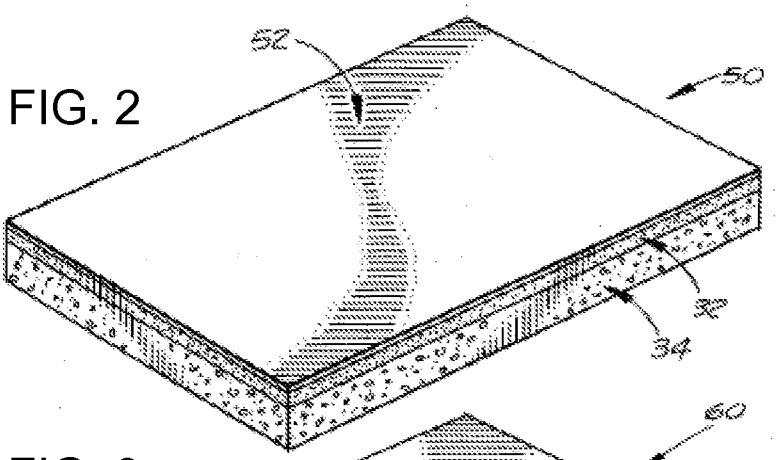


FIG. 3

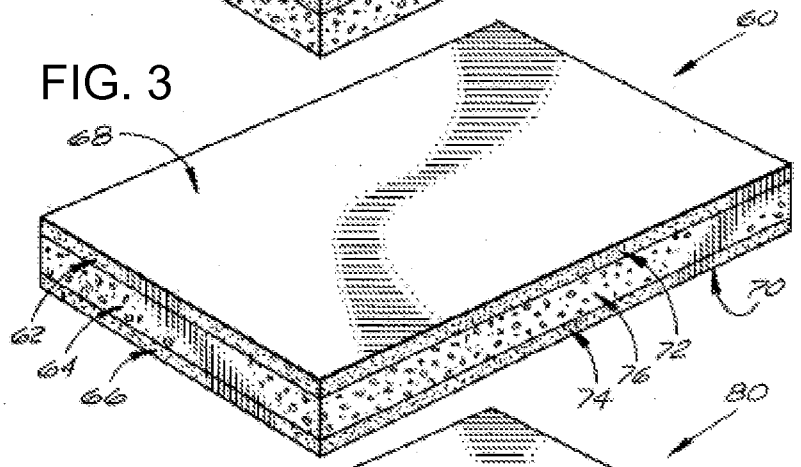
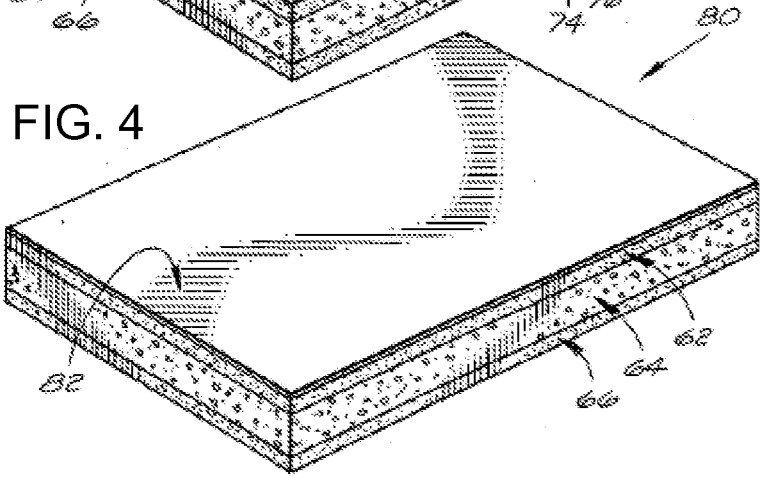


FIG. 4



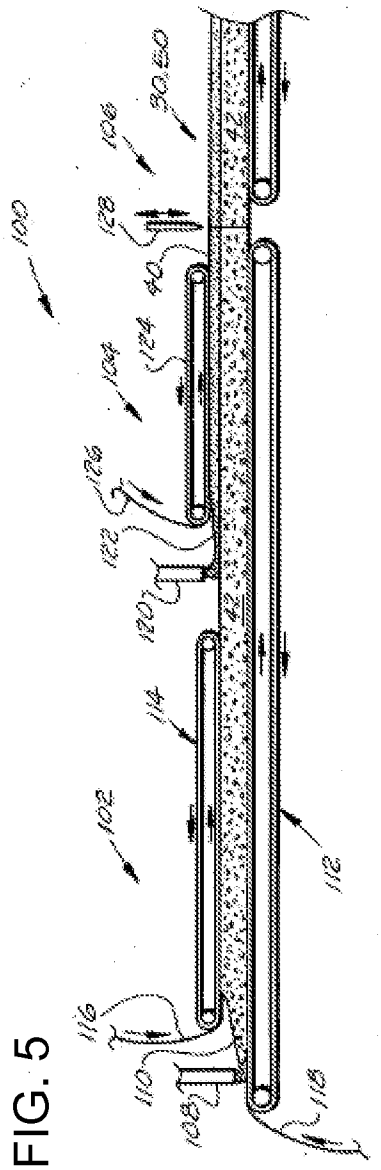

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FIG. 5

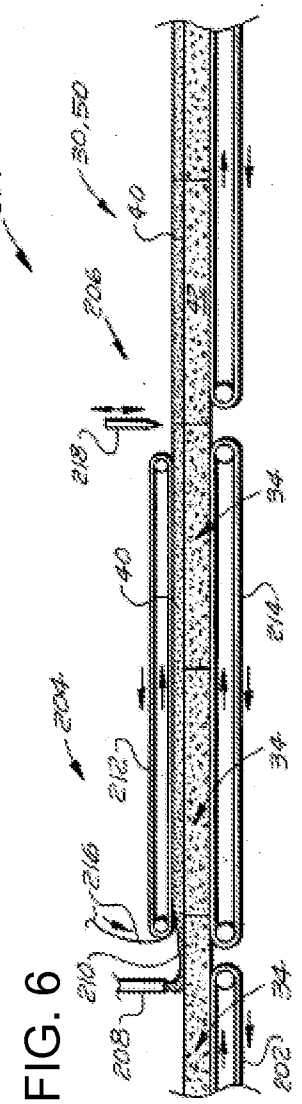

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FIG. 6

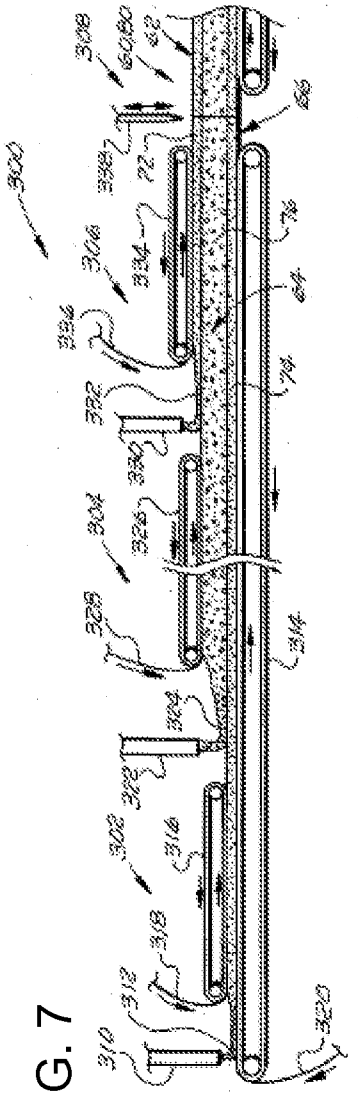

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FIG. 7

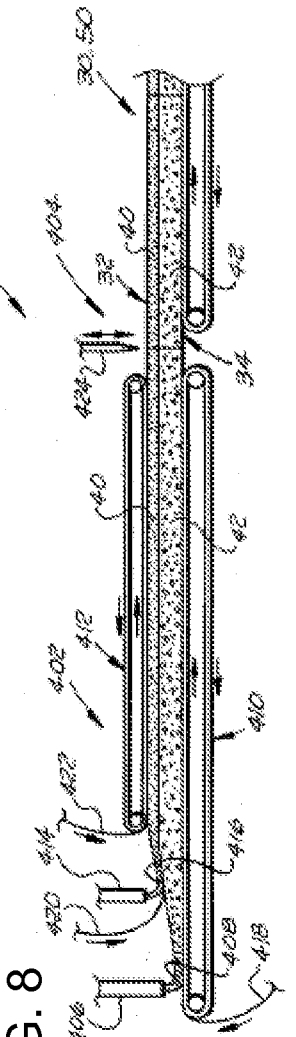

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FIG. 8

PREFABRICATED ROOFING PANEL COMPOSITE

FIELD OF ART

[0001] The present disclosure relates to a prefabricated roofing panel composite, which includes the high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board, and to a method of making the roofing panel composite.

BACKGROUND

[0002] Commercial and industrial buildings typically have roofs with low-slope roof decks. The roofing systems for these roofs with low-slope roof decks typically include one or more layers of a low-density roofing insulation, a layer of roofing cover boards that overlie the low-density roofing insulation layer(s), and a waterproofing membrane that overlies the layer of cover boards. The layer(s) of low-density insulation, such as a low-density polymer-based foam insulation, if not protected, can be partially crushed or otherwise damaged from worker traffic over the insulation, the placement of heaving objects on the insulation, the weather, and other causes commonly encountered in roofing construction. The layer of roofing cover boards that overlies the one or more layers of low-density insulation, protects the more fragile low density insulation from damage, acts as a fire barrier, provides a suitable substrate for the attachment of the overlying waterproofing membrane, and augments the insulating function of the low-density insulation. The uppermost waterproofing membrane layer overlying the cover board layer protects the underlying cover board and insulation layers from moisture and other adverse climatic conditions. Normally, these three components (the low-density insulation boards, the roofing cover boards, and the waterproofing membrane) of the roofing system are separately manufactured and separately and successively applied to the low-slope roof deck. While these roofing systems function very well, there has remained a need to prefabricated roofing panel composites that combine at least an insulation board and a roofing cover board layer, and that, preferably, combine an insulation board, a roofing cover board layer and a waterproofing membrane. With the use of such prefabricated roofing panel composites, roofing systems for low-slope roof decks can be improved and/or the time, labor and costs associated with the installation of roofing systems on low-slope roof decks can be reduced. Provided is an improved prefabricated roofing panel cover board and insulation board composite, and an improved prefabricated roofing panel cover board, insulation board, and waterproofing membrane composite. Also provided is a method for making the prefabricated roofing panel composites including roofing cover board that is highly productive, relatively economical, and efficient.

SUMMARY

[0003] The presently disclosed high-density polymer or predominantly polymer material cover board is or includes a high-density polymer or predominantly polymer material core layer with a density between 6 lbs/ft^3 and 25 lbs/ft^3. The density and thickness of the high-density polymer or predominantly polymer material core layer of the cover board are selected to provide the cover board with the compressive strength to resist deformation so that the cover board protects low-density insulation layers overlaid by the cover board from damage and so that the cover board has surface characteristics that promote the bonding of a top facer, e.g., waterproofing membrane, to the high-density core layer of the cover board. The presently disclosed prefabricated high-density polymer or predominantly polymer material cover board is relatively lightweight and easily cut. This makes the prefabricated roofing panel cover board and insulation board composite easier to install and increases the productivity of workers installing the prefabricated roofing panel cover board and insulation board composites. In addition, the presently disclosed high-density polymer or predominantly polymer material cover board does not support mold growth, there are no glass fiber shards to cause skin and eye irritation for installers, and the cover board is not negatively impacted by the application of solvents, hot asphalt, or adhesives.

[0004] The presently disclosed prefabricated roofing panel composites include the cover board with its high density polymer or predominantly polymer material core layer that has a density between 6 lbs/ft^3 and 25 lbs/ft^3 and a low-density insulation board with its low-density polymer or predominantly polymer material foam core layer that has a density less than or equal to about 2 lbs/ft^3. The bottom major surface of the high-density cover board overlies and is bonded to the top major surface of the low-density foam insulation board and, in a preferred embodiment, the high-density cover board includes a waterproofing membrane facer that overlies and is bonded to the top major surface of the high-density polymer or predominantly polymer material core of the cover board. The roofing panel composite may be secured in a roofing system mechanically with screws, nails or other mechanical fasteners and/or adhesively with asphalt or other adhesives.

[0005] When making the presently disclosed prefabricated roofing panel composites, the low-density polymer or predominantly polymer material foam core layer of the low-density foam insulation board may be formed with the high-density core layer of the high-density cover board being concurrently or subsequently formed over and bonded to a top major surface of the low-density foam insulation board in the same operation. In an alternate version of the method for making the presently disclosed prefabricated roofing panel composite, preformed low-density foam insulation boards may be fed into a production line with the high-density polymer or predominantly polymer material core layer of the cover board being formed over and bonded to the top major surfaces of the preformed low-density foam insulation boards. In the method for making the presently disclosed prefabricated roofing panel composite, no facer or a common facer may be used intermediate the high-density core layer of the cover board and the low-density foam core layer of the foam insulation board. In addition, a waterproofing membrane facer may be applied and bonded to the top major surface of the high-density polymer or predominantly polymer material core layer of the cover board.

[0006] In an embodiment, the presently disclosed prefabricated roofing system panel comprises a cover board an insulation board. The cover board can comprise a high-density predominantly polymer material core layer, the high-density core layer of the cover board having a density between 6 lbs/ft^3 and 25 lbs/ft^3, the high-density core layer of the cover board having a length, a width, and a thickness, the high density core layer of the cover board having a top major surface and a bottom major surface that are each defined by the length and the width of the high density core layer. The

insulation board can comprise a low-density predominantly polymer material foam core layer, the low-density foam core layer of the insulation board having a density less than or equal to about 2 lbs/ft^3, the low-density foam core layer of the insulation board having a length, a width, and a thickness, the low-density foam core layer of the insulation board having a top major surface and a bottom major surface that are each defined by the length and the width of the low-density foam core layer. The bottom major surface of the high-density core layer of the cover board and the top major surface of the low-density foam core layer of the insulation board can be substantially coextensive. The cover board and the insulation board can have a common nonwoven mat facer (e.g., a fiberglass mat) that overlies and is bonded to the bottom major surface of the high-density core layer of the cover board and the top major surface of the low-density foam core layer of the insulation board to bond the cover board and the insulation board together.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board.

[0008] FIG. **2** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board, a low-density polymer or predominantly polymer material foam insulation board, and a top facer.

[0009] FIG. **3** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board, a low-density polymer or predominantly polymer material foam insulation board, and a high-density polymer or predominantly polymer material baseboard.

[0010] FIG. **4** is a schematic perspective view of presently disclosed a prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board, a low-density polymer or predominantly polymer material foam insulation board, a high-density polymer or predominantly polymer material baseboard, and a top facer.

[0011] FIG. **5** is a schematic side view of a first production line that can be used to make a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board.

[0012] FIG. **6** is a schematic side view of a second production line that can be used to make a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board.

[0013] FIG. **7** is a schematic side view of a production line that can be used to make a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board, a low-density polymer or predominantly polymer material foam insulation board, and a high-density polymer or predominantly polymer material baseboard.

[0014] FIG. **8** is a schematic side view of a third production line that can be used to make a presently disclosed prefabricated roofing panel composite that includes a high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board.

DETAILED DESCRIPTION

[0015] FIG. **1** is a schematic perspective view of a presently disclosed first prefabricated roofing panel composite **30**. The prefabricated roofing panel composite **30** includes a high-density polymer or predominantly polymer material cover board **32** and an insulation board **34** that, as shown, are bonded directly together. The prefabricated roofing panel composite **30** has a top major surface **36** and a bottom major surface **38** that are each defined by the length and the width of the roofing panel composite. The prefabricated roofing panel composite **30** typically has a width of about four feet or greater and a length of about four feet or greater, preferably, about eight feet or greater and could have lengths that are limited only by the ability to store, transport and handle the roofing panel composites prior to installation.

[0016] In the prefabricated roofing panel composite **30**, the cover board **32** has a high-density polymer or predominantly polymer material core layer **40**. The high-density polymer or predominantly polymer material core layer **40** of the cover board **32** in the prefabricated roofing panel composite **30** has a density between 6 lbs/ft^3 and 25 lbs/ft^3 and preferably a density of at least 8 lbs/ft^3. The high-density polymer or predominantly polymer material core layer **40** of the cover board **32** in the prefabricated roofing panel composite has a thickness of about 0.25-0.5 inches. The density and thickness of the high-density polymer or predominantly polymer material core layer **40** of the cover board **32** are selected to provide the cover board with the compressive strength to resist deformation and protect the low-density insulation board **34** that is overlaid by the cover board from damage, and to provide surface characteristics that promote the bonding of a top facer, e.g., a waterproofing membrane, to the high-density core layer **40** of the cover board.

[0017] The insulation board **34** in the prefabricated roofing panel composite **30** includes a low-density polymer or predominantly polymer material foam core layer **42**. The low-density polymer or predominantly polymer material foam core layer **42** of the insulation board **34** has a density less than or equal to about 2 lbs/ft^3, preferably less than 4 lbs/ft^3, and typically a density between about 1 lbs/ft^3 and about 3 lbs/ft3. The low-density polymer or predominantly polymer material foam core layer **42** has a thickness of about 0.50-3.50 inches. The density and thickness of the low-density polymer or predominantly polymer material foam core layer **42** of the insulation board **34** are selected to provide the prefabricated roofing panel composite **30** with the desired insulating properties for the roofing system application.

[0018] The high-density polymer or predominantly polymer material core layer of the cover board may be made of various high-density polymer or predominantly polymer materials (e.g., a high-density polyisocyanurate, polyurethane, polystyrene, or phenolic material or a high-density material made of a blend of these materials; a high-density polyisocyanurate, polyurethane, polystyrene, or phenolic foam material or a high-density foam material made of a blend of these materials; a high-density predominantly polyisocyanurate, polyurethane, polystyrene, or phenolic material with inorganic filler(s) or a high-density material made of a blend of these materials with filler(s); a high-density pre-

dominantly polyisocyanurate, polyurethane, polystyrene, or phenolic foam material with inorganic filler(s) or a high-density foam material made of a blend of these materials with filler(s), a high-density material made of other thermoset matrix polymers; etc.). However, a preferred material for the high-density core layer is a high-density polyisocyanurate or predominantly polyisocyanurate material or foam material. The predominantly polymer materials of the high-density core layer may contain various powdered and liquid fillers, fiber reinforcements, fungi growth-inhibiting agents, and fire-retardants to reduce the cost of and/or modify the properties of the high-density core layer, such as but not limited to the compressive strength, the toughness, the flexibility, the friability, and the fire resistance of the core layer. Examples of fillers that may be used in the high-density predominantly polymer material core layer are fillers such as limestone ($CaCO_3$), fiberglass, recycled polyisocyanurate dust, and extenders/plasticizers.

[0019] The low-density polymer or predominantly polymer material foam core layer **42** of the insulation board **34** may be made of various low-density polymer or predominantly polymer foam materials (e.g., a low-density polyisocyanurate, polyurethane, polystyrene, or phenolic foam material or a low-density foam material made of a blend of these materials; a low-density predominantly polyisocyanurate, polyurethane, polystyrene, or phenolic foam material with inorganic filler(s) or a low-density foam material made of a blend of these materials with filler(s), a low-density foam material made of other thermoset matrix polymers; etc.). However, a preferred material for the low-density core layer **42** is a low-density polyisocyanurate or predominantly polyisocyanurate foam material.

[0020] When the high-density core layer **40** is made of a predominantly polymer material, the high-density predominantly polymer material of the core layer **40** may contain various powdered and liquid fillers, fiber reinforcements, fire-retardants, fungi growth-inhibiting agents, etc. to reduce the cost and/or modify the properties of the high-density core layer **40** (such as but not limited to the compressive strength, the flexibility, the friability, the fire resistance of the core layer). When the low-density core layer **42** is made of a predominantly polymer material foam, the low-density predominantly polymer material foam core layer **42** may contain various powdered and liquid fillers fiber reinforcements, fire-retardants, fungi growth-inhibiting agents, etc. to reduce the cost and/or modify the properties of the low-density predominantly polymer material foam core layer. Examples of fillers that may be used in the high-density core layer **40** of the cover board **32** and the low-density core layer **42** of the insulation board **34** are fillers such as limestone ($CaCO_3$), fiberglass, recycled polyisocyanurate dust, and extenders/plasticizers.

[0021] While, as shown in FIG. **1**, the prefabricated roofing panel composite **30** has no facers, the prefabricated roofing panel composite **30** could have a common facer intermediate and bonded to both the bottom major surface of the cover board core layer **40** and the top major surface of the insulation board core layer **42**, a top facer bonded to the top major surface of the cover board core layer **40**, and/or a bottom facer bonded to the bottom major surface of the insulation board core layer **42**. When used, the common facer of the prefabricated roofing panel composite **30** may be any sheet material with good bonding surfaces that facilitates a good bond between the cover board **32** and insulation board **34**, such as but not limited to woven or nonwoven mats made of glass fibers, other fibers or filaments, scrims, etc. When used, the top facer of the prefabricated roofing panel composite **30** overlies the entire or substantially the entire top major surface of the high-density core layer **40** of the cover board **32**. The top facer of the prefabricated roofing panel composite **30** may be any sheet material that provides a suitable top major surface for the prefabricated roofing panel composite **30**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc. When used, the bottom facer of the prefabricated roofing panel composite **30** overlies the entire or substantially the entire bottom surface of the low-density foam core layer **42** of the insulation board **34**. The bottom facer of the prefabricated roofing panel composite **30** may be any sheet material that provides a suitable bottom major surface for the roofing panel composite **30**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc.

[0022] FIG. **2** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite **50**. The prefabricated roofing panel composite **50** includes the high-density polymer or predominantly polymer material cover board **32** and the low-density polymer or predominantly polymer material foam insulation board **34** that, as shown in FIG. **2**, are bonded directly together, and a top facer **52**. Other than the inclusion of the top facer **52**, the prefabricated roofing panel composite **50** is the same as the prefabricated roofing panel composite **30** of FIG. **1**.

[0023] The top facer **52** of the prefabricated roofing panel composite **50** is bonded to and overlies the entire or substantially the entire top surface of the high-density polymer or predominantly polymer material core layer of the cover board **32**. The top facer **52** of the prefabricated roofing panel composite **50** may be any sheet material that provides a suitable top major surface for the cover board and facer composite, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc. However, a preferred sheet material for the top facer **52** is a sheet material that serves the dual function of providing a facing during the manufacturing process and a waterproofing membrane on the finished product such as but not limited to a bituminous or modified bituminous membrane, or a single ply membrane (e.g., a EPDM, PVC, or TPO membrane). Where the top facer **52** is a waterproofing membrane, the facer may extend beyond the high-density core layer of the cover board **32** on one or more of the four sides of the core layer, e.g., beyond a side edge and an end edge of the top major surface of the core layer to provide overlaps for sealing with the membranes of adjacent panels.

[0024] While, as shown in FIG. **2**, the prefabricated roofing panel composite **50** only has a top facer **52**, the prefabricated roofing panel composite **50** could have a common facer intermediate and bonded to both the bottom major surface of the cover board **32** core layer **40** and the top major surface of the insulation board **34** core layer **42**, and/or a bottom facer bonded to the bottom major surface of the insulation board **34** core layer **42**. When used, the common facer of the prefabricated roofing panel composite **50** may be any sheet material with good bonding surfaces that facilitates a good bond between the cover board **32** and insulation board **34**, such as but not limited to woven or nonwoven mats made of glass fibers, other fibers or filaments, scrims, etc. When used, the bottom facer of the prefabricated roofing panel composite **50** overlies the entire or substantially the entire bottom surface of

the low-density foam core layer of the insulation board **34**. The bottom facer of the prefabricated roofing panel composite **50** may be any sheet material that provides a suitable bottom major surface for the roofing panel composite **50**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc.

[0025] FIG. **3** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite **60** that includes: a high-density polymer or predominantly polymer material cover board **62**, a low-density polymer or predominantly polymer material foam insulation board **64**, and a high-density polymer or predominantly polymer material baseboard **66**. The high-density polymer or predominantly polymer material cover board **62** and baseboard **66** may have the same density or different densities. As shown in FIG. **3**, the cover board **62**, the insulation board **64**, and the baseboard **66** are bonded directly together. The prefabricated roofing panel composite **60** has a top major surface **68** and a bottom major surface **70** that are each defined by the length and the width of the prefabricated roofing panel composite. The prefabricated roofing panel composite **60** typically has a width of about four feet or greater and a length of about four feet or greater, preferably, about eight feet or greater and could have lengths that are limited only by the ability to store, transport and handle the roofing panel composites prior to installation.

[0026] In the prefabricated roofing panel composite **60**, the cover board **62** has a high-density polymer or predominantly polymer material core layer **72** and the baseboard **66** has a high-density polymer or predominantly polymer material core layer **74**. The high-density polymer or predominantly polymer material core layers **72** and **74** each have a density between 6 lbs/ft^3 and 25 lbs/ft^3 and preferably a density of at least 8 lbs/ft^3. The high-density polymer or predominantly polymer material core layer **72** of the cover board **62** and the high-density polymer or predominantly polymer material core layer **74** of the baseboard **66** each have a thickness of about 0.25-0.5 inches. The density and thickness of the high-density polymer or predominantly polymer material core layer **72** of the cover board **62** are selected to provide the cover board with the compressive strength to resist deformation and protect the low-density insulation board **64** that is overlaid by the cover board from damage, and to provide surface characteristics that promote the bonding of a top facer, e.g., a waterproofing membrane, to the core layer **72** of the cover board.

[0027] The insulation board **64** in the prefabricated roofing panel composite **60** includes a low-density polymer or predominantly polymer foam core layer **76**. The low-density polymer or predominantly polymer material foam core layer **76** of the insulation board **64** has a density less than or equal to about 2 lbs/ft^3, preferably less than 4 lbs/ft^3, and typically a density between about 1 lbs/ft^3 and about 3 lbs/ft^3. The low-density polymer or predominantly polymer material foam core layer **76** has a thickness of about 0.50-3.50 inches. The density and thickness of the low-density polymer or predominantly polymer material foam core layer **76** of the insulation board **64** are selected to provide the prefabricated roofing panel composite **60** with the desired insulating properties for the roofing system application.

[0028] The high-density polymer or predominantly polymer material core layers **72** and **74** of the cover board **62** and the baseboard **66** may be made of various high-density polymer or predominantly polymer materials (e.g., a high-density polyisocyanurate, polyurethane, polystyrene, or phenolic material or a high-density material made of a blend of these materials; a high-density polyisocyanurate, polyurethane, polystyrene, or phenolic foam material or a high-density foam material made of a blend of these materials; a high-density predominantly polyisocyanurate, polyurethane, polystyrene, or phenolic material with inorganic filler(s) or a high-density material made of a blend of these materials with filler(s); a high-density predominantly polyisocyanurate, polyurethane, polystyrene, or phenolic foam material with inorganic filler(s) or a high-density foam material made of a blend of these materials with filler(s), a high-density material made of other thermoset matrix polymers; etc.). However, a preferred material for the high-density core layers **72** and **74** is a high-density polyisocyanurate or predominantly polyisocyanurate material or foam material.

[0029] The low-density polymer or predominantly polymer material foam core layer **76** of the insulation board **64** may be made of various low-density polymer or predominantly polymer foam materials (e.g., a low-density polyisocyanurate, polyurethane, polystyrene, or phenolic foam material or a low-density foam material made of a blend of these materials; a low-density predominantly polyisocyanurate, polyurethane, polystyrene, or phenolic foam material with inorganic filler(s) or a low-density foam material made of a blend of these materials with filler(s), a low-density material made of other thermoset matrix polymers; etc.). However, a preferred material for the low-density core layer **76** is a low-density polyisocyanurate or predominantly polyisocyanurate foam material.

[0030] When the high-density core layers **72** and **74** are made of a predominantly polymer material, the high-density predominantly polymer material of the core layers **72** and **74** may contain various powdered and liquid fillers, fiber reinforcements, fire-retardants, fungi growth-inhibiting agents, etc. to reduce the cost and/or modify the properties of the high-density core layers **72** and **74** (such as but not limited to the compressive strength, the flexibility, the friability, the fire resistance of the core layer). When the low-density core layer **76** is made of a predominantly polymer material foam, the low-density predominantly polymer material foam core layer **76** may contain various powdered and liquid fillers fiber reinforcements, fire-retardants, fungi growth-inhibiting agents, etc. to reduce the cost and/or modify the properties of the low-density foam core layer. Examples of fillers that may be used in the high-density core layers **72** of the cover board **62** and the baseboard **66** and the low-density core layer **76** of the insulation board **64** are fillers such as limestone ($CaCO_3$), fiberglass, recycled polyisocyanurate dust, and extenders/plasticizers.

[0031] While, as shown in FIG. **3**, the prefabricated roofing panel composite **60** has no facers, the prefabricated roofing panel composite **60** could have a common facer intermediate and bonded to both the bottom major surface of the cover board core layer **72** and the top major surface of the insulation board core layer **76**, a common facer intermediate and bonded to both the bottom major surface of the insulation board core layer **76** and the top major surface of the baseboard core layer **74**, a top facer bonded to the top major surface of the cover board core layer **72**, and/or a bottom facer bonded to the bottom major surface of the baseboard core layer **74**. When used, the common facers of the prefabricated roofing panel composite **60** may be any sheet material with good bonding surfaces that facilitates a good bond between the cover board **62**, the insulation board **64**, and the baseboard **66**, such as but

not limited to woven or nonwoven mats made of glass fibers, other fibers or filaments, scrims, etc. When used, the top facer of the prefabricated roofing panel composite **60** overlies the entire or substantially the entire top major surface of the high-density core layer **72** of the cover board **62**. The top facer of the prefabricated roofing panel composite **60** may be any sheet material that provides a suitable top major surface for the prefabricated roofing panel composite **60**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc. When used, the bottom facer of the prefabricated roofing panel composite **60** overlies the entire or substantially the entire bottom surface of the high-density core layer **74** of the baseboard **66**. The bottom facer of the prefabricated roofing panel composite **60** may be any sheet material that provides a suitable bottom major surface for the roofing panel composite **60**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc.

[0032] FIG. **4** is a schematic perspective view of a presently disclosed prefabricated roofing panel composite **80**. The prefabricated roofing panel composite **80** includes the high-density polymer or predominantly polymer material cover board **62**, the low-density polymer or predominantly polymer material foam insulation board **64**, and the high-density polymer or predominantly polymer material baseboard **66**, that, as shown in FIG. **4**, are bonded directly together, and a top facer **82**. Other than the inclusion of a top facer **82**, the prefabricated roofing panel composite **80** of FIG. **4** is the same as the prefabricated roofing panel composite **60** of FIG. **3**.

[0033] The top facer **82** of the prefabricated roofing panel composite **80** is bonded to and overlies the entire or substantially the entire top surface of the high-density polymer or predominantly polymer material core layer of the cover board **62**. The top facer **82** of the prefabricated roofing panel composite **80** may be any sheet material that provides a suitable top major surface for the cover board and facer composite, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc. However, a preferred sheet material for the top facer **82** is a sheet material that serves the dual function of providing a facing during the manufacturing process and a waterproofing membrane on the finished product such as but not limited to a bituminous or modified bituminous membrane, or a single ply membrane (e.g., a EPDM, PVC, or TPO membrane). Where the top facer **82** is a waterproofing membrane, the facer may extend beyond the high-density polymer or predominantly polymer material core layer of the cover board **62** on one or more of the four sides of the core layer, e.g., beyond a side edge and an end edge of the top major surface of the core layer to provide membrane overlaps for sealing with the membranes of adjacent panels.

[0034] While, as shown in FIG. **4**, the prefabricated roofing panel composite **80** only has a top facer **82**, the prefabricated roofing panel composite **80** could have a common facer intermediate and bonded to both the bottom major surface of the cover board core layer and the top major surface of the insulation board core layer, a common facer intermediate andbonded to both the bottom major surface of the insulation board core layer and the top major surface of the baseboard core layer, and/or a bottom facer bonded to the bottom major surface of the baseboard core layer. When used, the common facers of the prefabricated roofing panel composite **80** may be any sheet material with good bonding surfaces that facilitates a good bond between the cover board and insulation board and the insulation board and the baseboard, such as but not limited to woven or nonwoven mats made of glass fibers, other fibers or filaments, scrims, etc. When used, the bottom facer of the prefabricated roofing panel composite **80** overlies the entire or substantially the entire bottom surface of the high-density core layer of the baseboard **66**. The bottom facer of the prefabricated roofing panel composite **80** may be any sheet material that provides a suitable bottom major surface for the prefabricated roofing panel composite **80**, such as but not limited to paper, foil, woven or nonwoven mats made of fiberglass or other fibers or filaments, scrims, etc.

[0035] FIG. **5** is a schematic side view of a first production line **100** that can be used to continuously make presently disclosed prefabricated roofing panel composites in line, such as the prefabricated roofing panel composites **30** of FIGS. **1** and **50** of FIG. **2**. The prefabricated roofing panel composites **30** and **50** each include a high-density polymer or predominantly polymer material cover board **32** and a low-density polymer or predominantly polymer material foam insulation board **34**. The production line **100** includes: a first forming station **102** for forming the low-density polymer or predominantly polymer material foam insulation board **34** of the prefabricated roofing panel composites **30** and **50**; a second forming station **104** for forming the high-density polymer or predominantly polymer material cover board **32** of the prefabricated roofing panel composites **30** and **50**; and a cutting station **106** for cutting the prefabricated roofing panel composites **30** and **50** to length.

[0036] The first forming station **102** for forming the low-density foam insulation board **34** includes a conventional dispenser **108** for dispensing a low-density polymer or predominantly polymer material foam precursor **110** (e.g., a low-density polyisocyanurate or predominantly polyisocyanurate foam precursor) onto a facer, when used, overlying a conveyor **112** of two spaced-apart opposed forming conveyers **112** and **114** or directly onto the conveyor **112**. As the foam precursor **110** passes between the forming conveyors **112** and **114**, foams and at least partially sets, the forming conveyors **112** and **114** cooperate to set the thickness of the low-density polymer or predominantly polymer material foam core layer **42** of the low-density polymer or predominantly polymer foam insulation board **34** formed from the precursor **110**. The first forming station **102** also includes supplies (e.g., rolls) of facer materials **116** and **118** that can be fed over and/or beneath the low-density polymer or predominantly polymer material foam precursor **110** to form a common facer of the prefabricated roofing panel composites **30** and **50** and a bottom facer of the prefabricated roofing panel composites **30** and **50**.

[0037] The second forming station **104** of the production line **100** for forming the high-density polymer or predominantly polymer material cover board **32** of the prefabricated roofing panel composites **30** and **50** includes a conventional dispenser **120** for dispensing a high-density polymer or predominantly polymer material or foam precursor **122** (e.g., a high-density polyisocyanurate or predominantly polyisocyanurate foam precursor) onto the low-density polymer or predominantly polymer material foam core layer **42** or, when used, a common facer overlying the low-density polymer or predominantly polymer material foam core layer **42**. With the high-density polymer or predominantly polymer material precursor **122** overlying the low-density foam core layer **42** or, when used, the common facer, the high-density polymer or predominantly polymer material precursor **122** and the low-

density foam core layer **42** pass between two spaced-apart opposed forming conveyers **112** and **124** where the high-density polymer or predominantly polymer material core layer **38** is formed and bonded directly to the low-density foam core layer **42** or to the common facer overlying the low-density foam core layer **42**. The spaced-apart opposed forming conveyors **112** and **124** cooperate to set the thickness of both the high-density polymer or predominantly polymer material core layer **40** and the prefabricated roofing panel composite **30** or **50**. The second forming station **104** also includes supplies (e.g., rolls) of a facer material **126** that is fed over the high-density polymer or predominantly polymer material precursor **122** to form the top facer **52** of both the high-density cover board **32** and the prefabricated roofing panel composite **50**.

[0038] With the high-density core layer **40** and the low-density foam core layer **42** of the prefabricated roofing panel composite **30** or **50** bonded together in the second forming station **104** to form a continuous length of the prefabricated roofing panel composite **30** or **50**, the prefabricated roofing panel composite **30** or **50** is then cut to length to complete the formation of the prefabricated roofing panel composite **30** or **50**. In the cutting station **106** a cutter, such as but not limited to a reciprocating cutter **128**, cuts the prefabricated roofing panel composite **30** or **50** coming from the second forming station **104** to length.

[0039] While the production line **100**, as shown, is capable of applying three facer materials **116**, **118**, and **126** to the insulation board **34** and the cover board **32** to form the prefabricated roofing panel composites **30** and **50**. The application of any one, any two, or all of the facing materials **116**, **118** and **126** to the insulation board and cover board can be omitted to form the prefabricated roofing panel composite **30** and all but the top facing material can be omitted to form the prefabricated roofing panel composite **50** with the desired number of facers. The facers **116**, **118** and **126** normally prevent the polymer or predominantly polymer layers from sticking to the conveyors. However, with a shift in the chemistry of the precursors **110** and **122** to affect the tackiness of the layers produced so that they do not stick to the surfaces of the conveyors or by applying release films or coatings to the surfaces of the conveyers that will not allow the layers produced to stick to the surfaces of the conveyors, when desired, any one or all of the facing materials are not needed for and could be eliminated from the manufacturing process.

[0040] FIG. **6** is a schematic side view of a second production line **200** that can be used to continuously make presently disclosed prefabricated roofing panel composites, such as the prefabricated roofing panel composites **30** of FIGS. **1** and **50** of FIG. **2**. The prefabricated roofing panel composites **30** and **50** each include a high-density polymer or predominantly polymer material cover board and a low-density polymer or predominantly polymer material foam insulation board. The production line **200** includes: an in-feed conveyor **202** for continuously feeding a series of low-density polymer or predominantly polymer material foam insulation boards **34** of the prefabricated roofing panel composite into a forming station **204**; the forming station **204** for forming the high-density polymer or predominantly polymer material cover board **32** of the prefabricated roofing panel composites **30** and **50**; and a cutting station **206** for cutting the prefabricated roofing panel composites **30** and **50** to length.

[0041] The low-density polymer or predominantly polymer material foam insulation boards **34** may include a top facer that, when used, forms a common facer of the prefabricated roofing panel composites **30** and **50** and may include a bottom facer that, when used, forms a bottom facer of the prefabricated roofing panel composites. Preferably, the low-density polymer or predominantly polymer material foam insulation boards **34** are fed into the forming station **204** lengthwise with the ends of successive insulation boards **34** in the continuous series of insulation boards abutting each other.

[0042] The forming station **204** of the production line **200** for forming the high-density polymer or predominantly polymer material cover board **32** of the prefabricated roofing panel composite **30** includes a conventional dispenser **208** for dispensing the high-density polymer or predominantly polymer material precursor **210** (e.g., a high-density polyisocyanurate or predominantly polyisocyanurate precursor) directly onto the low-density foam core layers **42** of the insulation boards **34** or, when used the common facers overlying the low-density foam core layers of the low-density foam insulation boards. With the high-density polymer or predominantly polymer material precursor **210** directly overlying the low-density foam core layers **42** of the insulation boards or the common facers **36** carried by the low-density foam insulation boards **34**, the high-density polymer or predominantly polymer material precursor **210** and the low-density foam insulation boards **34** pass between two spaced-apart opposed forming conveyers **212** and **214** where the high-density polymer or predominantly polymer material core layers **38** of the cover boards **32** are formed and bonded directly to the low-density foam core layers **42** of the insulation boards **34** or to the common facers overlying the low-density foam insulation board **34**. The spaced-apart opposed forming conveyors **212** and **214** cooperate to set the thickness of both the high-density polymer or predominantly polymer material core layer **40** and the prefabricated roofing panel composite **30** or **50**. The forming station **204** also includes supplies (e.g., rolls) of a facer material **216** that is fed over the high-density polymer or predominantly polymer material precursor **210** to form the top facer **52** of both the high-density polymer or predominantly polymer material cover board **32** and the prefabricated roofing panel composite **50**.

[0043] With the high-density core layer **40** and the low-density foam core layer **42** of the prefabricated roofing panel composite **30** or **50** bonded together in the forming station **204** to form a continuous length of the prefabricated roofing panel composite **30** or **50**, the prefabricated roofing panel composite **30** or **50** is then cut to length to complete the formation of the prefabricated roofing panel composite **30** or **50**. In the cutting station **206** a cutter, such as but not limited to a reciprocating cutter **218**, cuts the prefabricated roofing panel composite **30** coming from the forming station **204** to length.

[0044] The production line **200**, as shown, is capable of making the prefabricated roofing panel composite **30** by feeding preformed low-density polymer or predominantly polymer material foam insulation boards **34** into the forming station **204** and omitting the application of the facer material **216** to the cover board **32** and is capable of making the prefabricated roofing panel composite **50** by feeding preformed low-density polymer or predominantly polymer material foam insulation boards **34** into the forming station **204** and applying of the facer material **216** to the cover board **32**. The facer **216** normally prevents the high-density polymer or predominantly polymer material layer from sticking to the conveyor **212**. However, with a shift in the chemistry of the

precursor **210** to affect the tackiness of the layer produced so that the layer does not stick to the surface of the conveyor **212** or by applying a release film or coating to the surface of the conveyer **212** that will not allow the layer produced to stick to the surface of the conveyor, when desired, the facing materials **216** is not needed for and could be eliminated from the manufacturing process.

[0045] FIG. **7** is a schematic side view of a production line **300** that can be used to continuously make a presently disclosed prefabricated roofing panel composite, such as the prefabricated roofing panel composites **60** of FIGS. **3** and **80** of FIG. **4**. These prefabricated roofing panel composites each include: a high-density polymer or predominantly polymer material cover board **62**, a low-density polymer or predominantly polymer material foam insulation board **64**, and a high-density polymer or predominantly polymer material baseboard **66**. The production line **300** includes: a first forming station **302** for forming the high-density polymer or predominantly polymer material baseboard **66** of the prefabricated roofing panel composites **60** and **80**; a second forming station **304** for forming the low-density polymer or predominantly polymer material foam insulation board **64** of the prefabricated roofing panel composites **60** and **80**; a third forming station **306** for forming the high-density polymer or predominantly polymer material cover board **62** of the prefabricated roofing panel composites **60** and **80**; and a cutting station **308** for cutting the prefabricated roofing panel composites **60** and **80** to length.

[0046] The first forming station **302** for forming the high-density polymer or predominantly polymer material baseboard **56** includes a conventional dispenser **310** for dispensing a high-density polymer or predominantly polymer material precursor **312** (e.g., a high-density polyisocyanurate or predominantly polyisocyanurate precursor) onto a facer, when used, overlying a conveyor **314** of two spaced-apart opposed forming conveyers **314** and **316** or directly onto the conveyor **314**. As the precursor **310** passes between the forming conveyors **314** and **316**, forms and at least partially sets, the forming conveyors **314** and **316** cooperate to set the thickness of the high-density polymer or predominantly polymer material core layer **74** of the high-density baseboard **66** formed from the precursor **310**. The first forming station **302** also includes supplies (e.g., rolls) of facer materials **318** and **320** that may be fed over and/or beneath the high-density polymer or predominantly polymer material precursor **310** to form, when used, a common facer of the prefabricated roofing panel composites **60** and **80** and a bottom facer of the prefabricated roofing panel composites **60** and **80**.

[0047] The second forming station **304** of the production line **300** for forming the low-density polymer or predominantly polymer material foam insulation board **64** of the prefabricated roofing panel composites **60** and **80** includes a conventional dispenser **322** for dispensing a low-density polymer or predominantly polymer material foam precursor **324** (e.g., a low-density polyisocyanurate or predominantly polyisocyanurate foam precursor) directly onto the high-density core layer **74** or, when used, onto a common facer overlying the high-density core layer **74** of the baseboard **66**. With the low-density polymer or predominantly polymer material foam precursor **324** directly overlying high-density core layer **74** or the common facer overlying the high-density core layer **74** of the baseboard **66**, the low-density polymer or predominantly polymer material foam precursor **324** and the high-density core layer **74** pass between two spaced-apart opposed forming conveyers **314** and **326** where the low-density polymer or predominantly polymer material foam core layer **76** of the insulation board **64** is formed and bonded to the high-density core layer **74** or the common facer overlying the high-density core layer **74** of the baseboard **66**. The spaced-apart opposed forming conveyors **314** and **326** cooperate to set the thickness of the low-density polymer or predominantly polymer material foam core layer **76** of the insulation board **64**. The second forming station **304** also includes supplies (e.g., rolls) of a facer material **328** that can be fed over the low-density polymer or predominantly polymer material foam precursor **324** to form a common facer of the prefabricated roofing panel composites **60** and **80**.

[0048] The third forming station **306** of the production line **300** for forming the high-density polymer or predominantly polymer material cover board **62** of the prefabricated roofing panel composites **60** and **80** includes a conventional dispenser **330** for dispensing a high-density polymer or predominantly polymer material precursor **332** (e.g., a high-density polyisocyanurate or predominantly polyisocyanurate precursor) directly onto the low-density foam core layer **76** or the common facer overlying the low-density foam core layer **76** of the insulation board **64**. With the high-density polymer or predominantly polymer material precursor **332** overlying the low-density foam core layer **76** or the common facer overlying the low-density foam core layer **76**, the high-density polymer or predominantly polymer material precursor **332**, the low-density foam insulation board **64**, and the high-density baseboard **66** pass between two spaced-apart opposed forming conveyers **314** and **334** where the high-density polymer or predominantly polymer material core layer **72** of the cover board **62** is formed and bonded to the low-density foam core layer **76** or the common facer overlying the low-density foam core layer **76** of the insulation board **64**. The spaced-apart opposed forming conveyors **314** and **334** cooperate to set the thickness of both the high-density polymer or predominantly polymer material core layer **72** and the prefabricated roofing panel composite **60** or **80**. The third forming station **306** also includes supplies (e.g., rolls) of a facer material **336** that is fed over the high-density polymer or predominantly polymer material precursor **332** to form the top facer **82** of both the high-density cover board **62** and the prefabricated roofing panel composite **80**.

[0049] With the high-density polymer or predominantly polymer material cover board **62**, the low-density polymer or predominantly polymer material foam insulation board **64**, and the high-density polymer or predominantly polymer material baseboard **66** of the prefabricated roofing panel composites **60** or **80** bonded together in the third forming station **306** to form a continuous length of the prefabricated roofing panel composite **60** or **80**, the prefabricated roofing panel composite **60** or **80** is then cut to length to complete the formation of the prefabricated roofing panel composite **60** or **80**. In the cutting station **308** a cutter, such as but not limited to a reciprocating cutter **338**, cuts the continuous prefabricated roofing panel composite **60** or **80** coming from the third forming station **306** to length.

[0050] While the production line **300**, as shown, is capable of applying four facer materials **318**, **320**, **328**, and **336** to the baseboard **66**, the insulation board **64** and the cover board **62** to form the prefabricated roofing panel composites **60** and **80**. The application of any one, any two, any three or all of the facing materials **318**, **320**, **328**, and **336** to the baseboard, the insulation board and the cover board can be omitted to form

the prefabricated roofing panel composite **60** and all but the top facing material can be omitted to form the prefabricated roofing panel composite **80** with the desired number of facers. The facers **318**, **320**, **328**, and **336** normally prevent the composite layers from sticking to the conveyors. However, with a shift in the chemistry of the precursors **312**,**324**, and **332** to affect the tackiness of the layers produced so that they do not stick to the surfaces of the conveyors or by applying release films or coatings to the surfaces of the conveyers that will not allow the layers produced to stick to the surfaces of the conveyors, when desired, any one or all of the facing materials are not needed for and could be eliminated from the manufacturing process.

[0051] FIG. **8** is a schematic side view of another production line **400** that can be used to continuously make presently disclosed prefabricated roofing panel composites in line, such as the prefabricated roofing panel composites **30** of FIGS. **1** and **50** of FIG. **2**. The prefabricated roofing panel composites **30** and **50** each include a high-density polymer or predominantly polymer material cover board **32** and a low-density polymer or predominantly polymer material foam insulation board **34**. The production line **400** includes: a forming station **402** for forming the low-density polymer or predominantly polymer material foam insulation board **34** and the high-density polymer or predominantly polymer material cover board **32** of the prefabricated roofing panel composites **30** and **50**; and a cutting station **404** for cutting the prefabricated roofing panel composites **30** and **50** to length.

[0052] The forming station **402** for forming the low-density foam insulation board **34** and the high-density cover board includes a conventional dispenser **406** for dispensing a low-density polymer or predominantly polymer material foam precursor **408** (e.g., a low-density polyisocyanurate or predominantly polyisocyanurate foam precursor) onto a facer, when used, overlying a conveyor **410** of two spaced-apart opposed forming conveyers **410** and **412** or directly onto the conveyor **410**. The forming station **402** also includes a conventional dispenser **414** for dispensing a high-density polymer or predominantly polymer material precursor **416** (e.g., a high-density polyisocyanurate or predominantly polyisocyanurate material precursor) onto the low-density polymer or predominantly polymer material foam precursor of the core layer **42** or, when used, a common facer overlying the low-density polymer or predominantly polymer material foam precursor of the core layer **42**. As the layers of precursor **408** and **416** pass between the forming conveyors **410** and **412**, the precursors form and at least partially set, the forming conveyors **410** and **412** cooperate to set the thickness of the low-density polymer or predominantly polymer material foam core layer **42** of insulation board **34** formed from the precursor **408**, the thickness of the high-density polymer or predominantly polymer material core layer **40** of cover board **32** formed from the precursor **416**, and the thickness of the prefabricated roofing panel composite **30** or **50**. The forming station **402** also includes supplies (e.g., rolls) of facer materials **418**, **420**, and **422** that can be fed over and/or beneath the low-density polymer or predominantly polymer material foam precursor **408** to form a common facer of the prefabricated roofing panel composites **30** and **50** and a bottom facer of the prefabricated roofing panel composites **30** and **50** and that can be fed over the high-density polymer or predominantly polymer material precursor **416** to form a top facer of the prefabricated roofing panel composites **30** and **50**.

[0053] With the high-density core layer **40** and the low-density foam core layer **42** of the prefabricated roofing panel composite **30** or **50** bonded together to form a continuous length of the prefabricated roofing panel composite **30** or **50**, the prefabricated roofing panel composite **30** or **50** is then cut to length to complete the formation of the prefabricated roofing panel composite **30** or **50**. In the cutting station **404** a cutter, such as but not limited to a reciprocating cutter **424**, cuts the prefabricated roofing panel composite **30** or **50** coming from the forming station **402** to length.

[0054] While the production line **400**, as shown, is capable of applying three facer materials **418**, **420** and **422** to the insulation board **34** and the cover board **32** to form the prefabricated roofing panel composites **30** and **50**. The application of any one, any two, or all of the facing materials **418**, **420**, and **422** to the insulation board and cover board can be omitted to form the prefabricated roofing panel composite **30** and all but the top facing material can be omitted to form the prefabricated roofing panel composite **50** with the desired number of facers. The facers **418**, **420**, and **422** normally prevent the layers of the composite from sticking to the conveyors. However, with a shift in the chemistry of the precursors **408** and **416** to affect the tackiness of the layers produced so that they do not stick to the surfaces of the conveyors or by applying release films or coatings to the surfaces of the conveyers that will not allow the layers produced to stick to the surfaces of the conveyors, when desired, any one or all of the facing materials are not needed for and could be eliminated from the manufacturing process.

[0055] Preferably, the low-density polymer or predominantly polymer material foam precursors **110**, **324**, and **408** are low-density polyisocyanurate or predominantly polymer foam precursors. Preferably, the high-density polymer or predominantly polymer material precursors **122**, **210**, **312**, **332**, and **416** are high-density polyisocyanurate or predominantly polyisocyanurate material precursors. The high-density polymer or predominantly polymer material precursors **122**, **210**, **312**, **332**, and **416** can be formulated to produce high-density materials or foams by significantly reducing or eliminating the blowing agent(s) from the precursors **122**, **210**, **312**, **332**, and **416**. Pentane (HFC), micro-spheres, CO_2 and water (as well as other materials) will act as blowing agents for the precursors. The relatively high-density layers produced using these types of precursors have improved strength characteristics over the low-density foams normally produced for insulation products. As the amount of blowing agent is reduced in the precursors **122**, **210**, **312**, **332**, and **416**, the density and the compressive strength of the high-density layers produced increase. These types of high-density core layers are much more resistant to deformation than the typical low-density foam core layers.

[0056] While various embodiments have been described, it is to be understood that variations and modifications can be resorted to as will be apparent to those skilled in the art. For example, the prefabricated roofing panel composites could be in an upside down orientation to that shown and described in connection with the Figures. Such variations and modifications are to be considered within the purview and scope of the claims appended hereto.

What is claimed is:

1-20. (canceled)

21. A method of making prefabricated roofing system panels, comprising:

feeding a series of insulation boards that each comprise a low-density predominantly polymer material foam core layer having a density of less than or equal to about 2 lbs/ft^3 into a production line in a continuous process; the low-density foam core layer of each of the insulation boards having a width, a thickness, a length, and a top major surface and a bottom major surface that are each defined by the length and the width of the low-density foam core layer of the insulation board;

forming a cover board comprising a high-density predominantly polymer material core layer having a density between 6 lbs/ft^3 and 25 lbs/ft^3 and a width substantially equal to the widths of the low-density foam core layers of the insulation boards; the high-density core layer of the cover board being formed in a continuous process over and bonded to the top major surfaces of the low-density foam core layers of the insulation boards fed into the production line to form a composite; and

the composite being cut to the lengths of the low-density foam core layers of the insulation boards fed into the production line.

22. The method of making prefabricated roofing system panels according to claim **21**, wherein:

the thickness of the high-density core layer of the cover board is about 02.5-0.5 inches; and the thickness of low-density foam core layer of each of the insulation boards is about 0.50-3.50 inches.

23. The method of making prefabricated roofing system panels according to claim **21**, wherein:

the widths of the high-density core layer of the cover board and the low-density foam core layers of each of the insulation boards are each about 4 feet or greater; and the composite formed by the high-density core layer of the cover board and the low-density foam core layers of each of the insulation boards is periodically cut to form roofing systems panels that are each about 4 feet or greater in length.

24. The method of making prefabricated roofing system panels according to claim **21**, wherein:

the widths of the high-density core layer of the cover board and the low-density foam core layers of each of the insulation boards are each about 4 feet or greater; and the composite formed by the high-density core layer of the cover board and the low-density foam core layers of each of the insulation boards is periodically cut to form roofing system panels that are each about 8 feet or greater in length.

25. The method of making prefabricated roofing system panels according to claim **21**, wherein:

the polymer material of the high-density core layer of the cover board and the low-density foam core layers of each of the insulation boards is polyisocyanurate.

26. The method of making prefabricated roofing system panels according to claim **21**, wherein:

the low-density foam core layers of each of the insulation boards have top and bottom facers that overlie and are bonded to the top and bottom major surfaces of the low-density foam core layers of each of the insulation boards; and

a top facer is applied to the high-density core layer of the cover board during the formation of the high-density core layer of the cover board that overlies and is bonded to a top major surface of the high-density core layer of the cover board and the top facers of the low-density foam core layers of the insulation boards become a bottom facer for the high-density core layer of the cover board.

27. The method of making prefabricated roofing system panels according to claim **26**, wherein:

the top facer applied to the top major surface of the high-density core layer of the cover board is a waterproofing membrane

28-43. (canceled)

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