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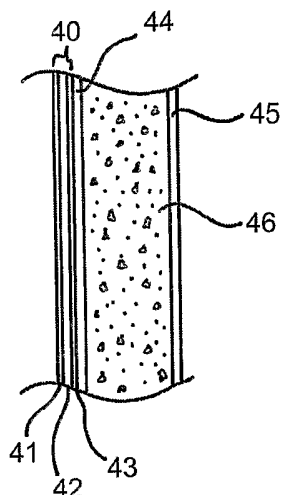
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(54) Title: THERMAL INSULATION MATERIAL



(57) Abstract: The present invention relates to a thermally insulating material. In preferred embodiments the material is a sheet or in roll form, and comprises a metallised plastic film layer (41, 43) adhesively bonded to a substrate (42). The substrate (42) is preferentially absorbent to the adhesive, allowing penetration to enhance the surface and edge moisture resistance properties of the material. The material may be used in its simplest form as an insulating lining, though may also be coupled to building elements or supplementary insulating materials to increase its utility and uses in building construction and renovation.

THERMAL INSULATION MATERIAL

FIELD OF INVENTION

This invention relates to thermal insulation materials, a primary envisaged use being as insulation materials for use in insulating floors, walls, and/or roofs of domestic and commercial buildings. In preferred embodiments the invention comprises a sheet or roll product, though in other embodiments the invention comprises an insulating face for a building element. Other variations include insulating tapes, and insulating elements where a sheet is coupled with an alternative insulating material.

The invention may also find use in practically any situation where thermal insulation is required, including the perishable goods packaging industry, and specialised applications.

BACKGROUND DESCRIPTION

An accepted and well recognised measure of insulation performance of insulation materials in buildings is the "R value" which has units of m^2K/W . An R value is effectively a measure of thermal resistance – the higher the value, the better the material's thermal insulation properties.

For many years building insulation has been provided by padding or batting, typically of a fibrous material such as glass fibre, which is a relatively efficient thermal insulation material. However, the installation of batting is highly labour intensive, while the contact of glass fibre batting with human skin can cause irritation to an installer.

Batting has a thickness of the order of around 100mm, and in order to achieve a higher R value or insulation level with batting it is usually necessary to increase the thickness of the batting. This is not always possible, for example in confined spaces. For example, at a thickness of around 75mm fibreglass batting may have an R value of around 1.8 whereas a thickness of 190mm may provide an R value of around 5. With most modern wall framing comprising an actual internal thickness in the range of 69 – 100mm, there are practical limits to the achievable R value for batting and fibrous materials. Additionally, batting and in-fills are restricted to voids within the framing, and do not address transmission which may occur through structural elements of the framing. Where metal framing is used, these losses may be significant, though little attention has been given to loss by conduction through wooden studs and elements. Hence, batting and in-fills provide only thermal insulation from heat loss through the voids in a wall or framing structure. Furthermore, batting provides little or no resistance to moisture ingress and has no structural strength.

Another existing thermal insulation material is sarking which is a waterproof laminated foil or paper material used in roofing, under the outer roofing. First generation sarking consisted of Kraft paper and bitumen. Second generation sarking consisted of Kraft paper, bitumen and aluminium foil. More recently, sarking included flame-retardant adhesives and different types of reinforcement fibres. An example of sarking material is the product sold under the trade

mark SISALATION®, at least in New Zealand and Australia. Although the thermal resistance (R value) of sarking is acceptable it has very low strength and is usually highly reflective making it difficult to handle and awkward to install. Typical sarking typically has R values of between about 1.5 and about 2.5. It should be noted that the inclusion of conductive foils in sarking, while reflecting heat, also has the disadvantage of being an electrical conductor.

Other existing building insulation materials include various forms of foam, balls and flakes formed from expanded polystyrene (EPS), shredded paper, natural wool and polyester which are all flammable and therefore require additional fire retardant treatments. Many of these suffer from similar problems as has been mentioned in relation to batting and in-fills.

In an attempt to address these problems, a product appeared on the Australian market as is disclosed in patent specification WO2004/016427 by Steentjes. However, this product was withdrawn from the market soon after its release due to some significant problems. In particular it was susceptible to blistering and delamination. Blistering and delamination, particularly at edges of sheets, was a consequence of condensation build up (which can occasionally occur). Another problem was exposure to the elements during construction, with exposure to rain leading to delamination of the outer surfaces from the substrate, and breakdown of the substrate itself.

This product did address many of the problems associated with previous types of insulation such as in-fill and batting, though was unsuitable for construction use due to the types of problems previously mentioned.

It would be an advantage to produce a thermal insulation material suitable for use in the building industry which is thin, easy to install in new and/or retro-fitted type installations, has a relatively high R value, is moisture resistant and/or is resistant to degradation from exposure to moisture, is economical to produce, has structural strength, or possesses a combination of at least two or more of these features.

It is therefore an object of the present invention to provide a thermal insulation material which will go at least some way towards overcoming the above disadvantages or addressing the above problems.

At the very least it is an object of the present invention which will provide the industry with a useful choice in an insulation material.

GENERAL DESCRIPTION OF THE INVENTION

According to one aspect of the present invention there is provided a thermal insulation product comprising:

a metallised plastics film layer and

a substrate which is absorbent to a moisture resistant adhesive, which is resistant to moisture after curing, said adhesive being used for bonding said metallised plastics film layer to a major face of the substrate,

5 the arrangement being further characterised in that there is penetration of adhesive into the substrate to increase or supplement at least either or both of its surface and edge moisture resistance properties.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate is a sheet material.

10 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate is a fibrous material.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate is a paper-based substrate layer containing cellulose fibres.

15 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate has been treated to enhance its resistance to degradation by moisture.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the treated substrate is absorptive to an adhesive which is water based.

20 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate comprises a maximum of 50% of recycled paper material.

25 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the recycled paper material substantially comprises recycled paper material that has been recycled only once.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the substrate comprises substantially 100% virgin cellulose fibre.

30 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which includes a filler or binder material comprising at least one of clay, starch, and glue.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is present between 5% to 25% inclusive, by weight, of filler or binder material.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the mass of the substrate layer is between 50gsm and 500gsm inclusive.

- 5 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the mass of the substrate layer is between 100gsm and 200gsm inclusive.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the metallised plastics film comprises a metallised polyester film.

- 10 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the plastics film of the metallised plastic film is metallised on one side, and either corona or chemically treated on the other side.

- 15 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the metallised plastics film layer has a thickness of between about 10 μ m and about 15 μ m

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the mass of the metallised plastics film layer is between 15g/m² to 20g/m² inclusive.

- 20 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is bonded to one side said substrate a reinforcing material.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the reinforcing material is a fibrous or mesh material.

- 25 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the reinforcing material contains at least one of glass fibres, silk, or synthetic fibres.

- 30 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said fibres possess a high tensile strength.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said reinforcing material is positioned between a said metallised plastics film layer and the substrate to which it is adhesively bonded.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the adhesive is a water borne synthetic resin.

5 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the adhesive has a methacrylic acid base.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which is a Poly (2-chloro-1,3-butadiene/methacrylic acid) resin.

10 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which between 4g/m² to and 6g/m² inclusive of adhesive is applied between a metallised plastics film layer and substrate.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is adhesively bonded a metallised plastics film layer to both alternate major faces of a substrate.

15 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which is permeable to water vapour.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which at least the metallised plastics film layers are perforated.

20 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which at least some of said perforations are micro-perforations.

25 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the average diameter of the micro-perforations is 20 microns or less.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the maximum diameter of a micro-perforation is 125 mils.

30 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is adhesively bonded a metallised plastics film layer to both alternate major faces of a central substrate.

35 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which comprises multiple alternating bonded layers of metallised plastics film and substrate, there optionally being reinforcing materials included within the structure.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said product is in roll form.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which is bonded to a building element.

- 5 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said building element comprises a gypsum type wall board.

- According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said building element comprises a member of a group comprising: a concrete block, a brick, a construction block, a
10 prefabricated concrete structure, a tile, a ceiling tile, a flooring tile, a wall tile.

- According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said building element comprises a member of the group comprising: a wall board, a shower-lining board, a construction board, a
15 sheet of plywood, a board of reconstituted wood or fibre material, a glass panel, a plaster board or sheet, a fibrous cement board or sheet, a sheet of plastics laminate, a metal sheet, a board of at least part metal construction.

- According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said building element comprises a member of the group comprising: a door, a door panel, a wall panel, a floor panel, a ceiling
20 panel, a panel of semi-hollow or hollow construction.

- According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which said building element comprises a member of the group comprising: a length of timber, a timber board, a prefabricated
25 interlocking timber construction element, a timber lining material.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which is attached to a supplementary insulating material.

- According to another aspect of the present invention there is provided a thermal insulation
30 product, substantially as described above, in which the insulating material comprises a member of the group comprising: a panel or sheet of an expanded polystyrene, a panel or sheet of an expanded insulating material, a panel or sheet of an expanded fibrous or spun material, a batt of an expanded fibrous material, a batt of an expanded glass fibre insulating material.

- 35 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is included a stiffening element.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the stiffening element is a sheet of a material.

5 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which the arrangement of components comprises at least one of:

- a said stiffening element is intermediate the supplementary insulating material and a thermal insulation product as substantially as described above;
- a thermal insulation product as substantially as described above, is intermediate the
10 stiffening element and supplementary insulating material.

According to another aspect of the present invention there is provided a thermal insulation product in the form of an adhesive tape or sheet, said tape or sheet comprising a thermal insulating product substantially as described above in combination with a tacky or activatable adhesive layer.

15 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is an intermediate protective layer between the tacky or activatable adhesive layer and the thermal insulating product substantially as described above.

20 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is a removable backing layer protecting the tacky or activatable adhesive layer.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, in which there is an intermediate heat shielding layer between the tacky or activatable adhesive layer and the thermal insulating product
25 substantially as described above.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, when used as a lagging for pipes or conduits.

30 According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, when used in either of both of building construction or renovations.

According to another aspect of the present invention there is provided a thermal insulation product, substantially as described above, which is manufactured by lamination in a continuous strip.

35 According to a further aspect of the present invention there is provided a method of manufacturing a thermal insulating product, substantially as described above, said method comprising:

feeding continuous lengths of substrate and of metallised plastics film to a laminator and adhesively laminating the metallised plastics film to the substrate to form a continuous strip of thermal insulation material.

5 According to another aspect of the present invention there is provided a method, substantially as described above, in which the adhesive is introduced to either or both a metallised plastics film and substrate prior to the combination.

According to another aspect of the present invention there is provided a method, substantially as described above, in which heated rollers are used to assist curing of the adhesive.

10 According to another aspect of the present invention there is provided a method, substantially as described above, in which the lamination process is operated to produce a thermal insulating product at a linear speed of between 100m/min and 500m/min inclusive.

15 According to a further aspect of the present invention there is provided a method of manufacturing a thermal insulating product comprising introducing to either or both of a metallised plastics film layer and a substrate which is absorbent to a moisture resistant adhesive, a curable moisture resistant adhesive for bonding same; said layers then being brought into close face to face contact such that there is penetration of adhesive into the substrate to increase or enhance at least either or both of its surface and edge moisture resistance properties, curing of the adhesive being optionally accelerated by heating.

20 In the development of the present invention it was decided to produce a product with a fibre based substrate, typically a paper based substrate due to availability, and existing knowledge in relation to using such materials in a lamination process. While the problems of failed prior art products utilising paper cores were known, it was nevertheless decided to investigate the possibility of solutions having the ability to use fibre and paper based substrates. While it is possible to consider a film substrate comprising a water resistant product such as plastics or silk, there are a number of potential drawbacks. Firstly, the adhesive must still be resistant to moisture otherwise the delamination problems of the prior art remain. Secondly, many of these products can be more expensive than a paper base, particularly when produced with the stiffness and thickness desirable for imparting to the end product. Finally, there is some advantage in the use of a renewable materials source for a substrate.

35 A further problem associated with most of these alternative substrates were that the adhesives suited to these substrate materials are petroleum based. Most existing laminators are not able to operate with petroleum based adhesives as they are not designed to enable removal of the solvents which are given off in the curing process. It was therefore considered that there were commercial advantages associated with being able to use existing lamination equipment without the need for and capital cost associated with specialised lamination equipment. Accordingly it was decided to provide a solution which was able to be

applied to a relatively inexpensive paper-based substrate, and could be used on standard lamination equipment.

Ordinarily, a water-based adhesive will bond well to the cellulose fibres within a paper-based substrate but upon the application of water to the product (particularly at the edges),
5 delamination will normally occur by weakening or breaking the bonds between the cellulose fibres and the adhesive. This is also applicable for synthetic papers when non-cellulose fibres may be present. In the present invention, the treatment of a paper-based substrate layer increases the ability of at least some of the cellulose fibres (the treatment may be applied to all or only a constituent of the substrate) to absorb and retain adhesive (even
10 when exposed to moisture).. Surprisingly, as a consequence of development and trials a sheet product was obtained in which the resulting bond between the substrate and plastics film layer is not weakened by the addition of water. Such a product did not delaminate upon contact with water, and the combination of glue and substrate performed in excess of all reasonable expectations for a product of this type. The nature of the resulting product
15 opened up a number of possibilities for new and unique products with increased functionality, as well as an improved sheet type thermal insulating product suitable for use in construction and a variety of other applications. These will become more apparent from the ensuing description.

In its simplest forms the present invention comprises a thermal insulation product which
20 comprises a metallised plastics film layer bonded to a substrate. This substrate should be absorbent to the bonding adhesive used for laminating the film layer to the substrate. The absorbency should be such that there is penetration into the substrate, at least on the face to which the film layer is bonded, and ideally sufficient to provide some edge resistance to moisture if the product is cut.

25 The ability to resist moisture, and the unwanted consequential effects of blistering or delamination arising from moisture degradation, is important in the present invention. In the present invention this is accomplished by the use of either, and preferably both, of two techniques. The first is to utilise a bonding adhesive which, when cured, is moisture proof or moisture resistant – in this specification the term ‘moisture resistant’ shall also include:
30 moisture proof, water-proof, and water resistant. However, this bonding adhesive needs to be compatible with the substrate to ensure penetration into the substrate sufficient for the bonding adhesive to impart at least some of its moisture resistant properties to the substrate itself.

The second technique is to utilise a substrate which is moisture resistant, or includes some
35 such properties. The greater the moisture resistant properties of the substrate, then the less the reliance on adhesive penetration to enhance the moisture resistant properties though adhesive penetration does have the potential to help further reduce delamination by keying with the substrate. The use of both techniques is therefore adopted in preferred embodiments of the present invention.

Additionally, preferred embodiments of the present invention rely on less aggressive bonding adhesives to maximise compatibility between the components over the long period normally expected for the lifetime of an insulating product. These less aggressive bonding adhesives tend to be water or aqueous based, which can sometimes be problematic in terms of their adhesion to highly water resistant substrates. This again introduces considerations of compatibility between the substrate and bonding adhesive.

In preferred embodiments the substrate is paper based, though ideally has been treated to have some inherent properties of moisture resistance, or resistance to degradation by exposure to moisture. The preferred bonding adhesive, which penetrates into the structure of this substrate, increases the resulting moisture resistance of the product.

The degree of moisture resistance, choice of substrate, and choice and depth of adhesive penetration will vary among different embodiments. In dry and warm environments exposure to moisture may be limited, and thus only moderate to high moisture resistance may need to be considered. However, other applications may be in more demanding conditions where condensation arising from significant fluctuations in temperature, and high relative humidity, require higher moisture resistance in a product. The expected lifetime of the product will also affect choices made during fabrication. Some specific examples and choices will be given later in this specification.

The product may take a number of forms, though the following section shall refer to the most common type of embodiments – the sheet or roll form. Here the nature of the product is largely determined by the parameters of the substrate – a thicker or thinner substrate determining largely the thickness and nature of the product. While a wide range of thicknesses may be used, the inventor considers that a standard insulating sheet for construction use is best served by a sheet substrate base typically within the range of 50gsm to 500gsm inclusive, and more ideally within the 100gsm to 200 gsm range (inclusive). These ranges are quoted in respect of a paper based substrate, and may need to be translated into other units when other types of substrate are used – the primary qualities being compared including thickness, strength, and stiffness, though the latter two will be influenced by adhesive penetration and are best compared between finished products.

These ranges tend to allow, for preferred choices of substantially paper based substrates, good adhesive penetration to a depth that moisture attack at the edges of a sheet are relatively minimal or insignificant – however manufacturing parameters can also be used to control these properties for different types and thicknesses of paper.

The metallised plastics film is preferably a metallised polyester film, though other film choices may be made. Breathable films, and films which allow water vapour to pass, may also be considered for more specialised embodiments of the present invention.

The metallised film is typically prepared by the application of a thin metal layer to at least one side. Such films are known, as are their specific properties and methods of manufacture – so shall not be repeated here.

5 One side of the metallised plastics film may be modified to improve adhesion to a bonding adhesive. Particular treatments include corona treatment, chemical treatment, etching and surface roughening by various methods.

The metallised plastics film may be applied to either or both sides of the substrate. For a sheet or roll product such as typically will be used for wall, floor, or ceiling insulation, a metallised plastics film will be applied to both sides of the substrate. The metallised plastics
10 film is more likely to be attached to only one side of a substrate where that substrate is to be bonded to something else, such as a building element.

More complicated structures comprising multiple alternating layers of substrate and metallised plastics films may also be constructed for more specialised applications. Again, a metallised plastic film may be applied to either or both outermost faces of the laminate,
15 depending on how it is to be used.

Reinforcing may also be included into products of the present invention. While this may be included within the substrate itself, it is more common for reinforcing to be positioned between a metallised film layer and substrate, typically being introduced during the manufacturing process. Preferred reinforcing comprises fibres, threads or cords, filaments,
20 mats or meshes, etc. and may be of a variety of materials including: glass and ceramic fibres, silk, natural fibres, nylon, synthetic filaments or fibres, high tensile or ballistic fibres, metal, and composites. Standard building construction tends not to require high strength or penetration resistant, though specialised embodiments can provide for specialised products with high strengths and resistance to penetration. Multiple installed layers of such
25 specialised products may be considered for applications requiring some resistance to projectile penetration.

Various modifications may be made to invention. For instance, perforations may be made through one or more layers to improve moisture penetration where a breathable rather than barrier layer is required. These may be of varying size, such as used in foil type insulation
30 products, though consideration needs to be given to the potential loss of thermal insulating capability from too free an air flow. The use of two separated layers of perforated thermal insulation product in a wall cavity (for instance) can partially address this. So too can reducing the specific perforation size.

The use of micro-perforations can be used to minimise air flow but allow the transfer of
35 moisture vapour from one side to another. The maximum size of such micro-perforations is typically 125 mils, the preference being for an average micro-perforation diameter of 20 mils or less.

Micro-perforations of specific shape, such as disclosed in USSN 09/537,243, may be performed to improve noise absorption properties of the resulting product – yielding a product with thermal insulation and noise controlling properties.

5 Various sheet and roll embodiments may find a variety of applications. Common applications comprise use as an insulating material in buildings, such as under flooring, in wall structures, and in roof and ceiling structures – typically replacing foil and other types of insulating materials. They may also be combined with other building elements, and materials, as will be discussed further. The sheet and roll, as well as other embodiments of the present invention, may also find use in a variety of applications. They may find use in the insulation of cool
10 rooms or heating rooms, or any other interface requiring insulation. They may be used in the production of storage containers for helping maintain products and contents at a particular temperature, as well as insulating materials in various equipment, both domestic and commercial. It may find use as a strong and lightweight insulating material in vehicle construction, including aircraft, cars, trucks (and trailer units), etc.

15 More specialised applications of sheet and roll embodiments, such as discussed above, exist. For instance, a tacky or activatable adhesive layer may be applied to an external face. A protective removable backing layer may be provided, depending on the nature of the adhesive. In sheet or roll form, such embodiments may be bonded to building structures and elements – e.g. a block wall, a wall, a panel, car panels, shipping container walls, etc. These
20 may be particularly useful for retrofitting insulation and in renovations, or for modifying a building element or component prior to insulation.

If formed into a tape form, the product can then be used as a thermal lagging for pipes, and perhaps also to address resonant vibrations that affect some plumbing systems. It can find use in plumbing, air conditioning, venting, and ducting systems. The embodiments may be
25 made more flexible, such as by using a thinner substrate. Relative strength can be increased by using a substrate with longer fibres, and by considering the use of reinforcing layers, including tough plastic films (to which the substrate or metallised film may be attached).

Another main group of variations of embodiments comprise applying sheet or roll type embodiments to building elements. The building elements may comprise any type of material
30 used in construction, whether of buildings, vehicles, storage containers, shipping containers, etc. – not just being for dwellings and commercial buildings. A variety of examples will be mentioned, though this list is not exhaustive. For instance, the insulation product may be incorporated into the interior of hollow doors. It may be applied as a lining on one side of garage doors. It may be applied to the exterior of bathroom and shower lining panels to help
35 reduce condensation build up, and as a control barrier for moisture.

A significant use is seen as a lining for plaster type wall boards, such as commonly sold in NZ as Gib® board. Here either an exposed substrate may be directly bonded to the paper face of the wallboard, or a sheet with metallised plastics film on both sides attached. Similar

adhesives as used for bonding the metallised plastics film and substrate may be considered and used. The result is a wall-board with enhanced thermal insulation properties, to the extent that additional insulation may not be required. There are also possible increases in the performance properties of such wall-boards in fire-control wall systems, due to the
5 decreased thermal transmittance.

Thermally insulating tapes for joining such tapered wall boards may be provided. These may take a number of forms. For instance a metallised plastic film sandwiched between two substrate layers can be provided. A reinforcing layer may be optionally provided. The outer exposed surface of the substrates may not be exposed or subject to full bonding adhesive
10 penetration – allowing for keying of stopping plaster on the tape. Alternatively one face may be a metallised plastics film with an adhesive layer enabling it to adhere to the tapered region between adjacent wallboards – a protective backing for the adhesive face may be provided. Various permutations and combinations of these can be considered in various embodiments of a tape.

15 Other possibilities for building elements include application to the face of building blocks, such as concrete, masonry, and lightweight blocks (such as Hebel® blocks). Again a suitable adhesive may be used, preferably but not necessarily a water based adhesive. A separate primer or sealer may be applied to the block though the adhesive may also be a primer and/or sealer. The resulting block will not only possess thermal insulating properties, but can
20 also include enhanced moisture barrier properties.

Another type of building element are the interlocking elements used in the construction of buildings, such as well known in relation to Lockwood® homes and construction. Here the thermally insulating layer can be applied to one or more faces of the interlocking elements. Where hollow type interlocking elements are used, the thermally insulating layer can be
25 attached to an internal face of one or more of the panels used in its construction. The thermally insulating layer may be attached to timber used in the interlocking element prior to its construction. Preferably the insulating layer is adhesively bonded, though mechanical attachment methods may be used.

Another example is the attachment of the thermal insulation layer to cladding and lining
30 materials. This may include timber, and may include interlocking or overlapping lengths (e.g. T&G, ship-lock, etc.) such as may be used for flooring, cladding, weather boards, wall linings, ceiling linings, etc. The insulating layer is typically also adhesively bonded to at least one face of the timber. This may be applied prior to milling or machining operations to form overlapping and interlocking elements, though post application to machined lengths can
35 allow the thermal insulating layer to continue around and cover at least part of the overlapping or interlocking portions, increasing the total thermal insulating properties. Again, variations in the possible design of the thermal insulating layers allow the overall properties of the timber element to be modified, including thermal insulation properties, moisture barrier properties, noise control properties, and a possible barrier to flora and fauna. It also

allows for such properties to be imparted without the builder or tradesperson having to deviate from standard installation practices as the resulting modified building element can normally be used according to standard practices. It also provides the ability to retrofit insulated materials during renovations – for instance, replacement floorboards, cladding, ceiling linings etc. can be modified elements according to the present invention, particularly allowing the installation of thermally insulating properties where space is limited or access to voids (for inserting in-fill type insulating materials) is limited or not possible.

It should be envisaged that the sheet-like thermal insulating laminate may be applied to various types of timber lengths (where warranted). Application to the rear of mouldings such as scotia, architrave, and skirting etc. (and this also applies to non-wooden mouldings) allows improved thermal insulation at the interfaces of walls, floors, and ceilings etc – an area which can be susceptible to heat loss (and reduced sound insulation) when relying solely on in-fill type insulation materials.

The thermally insulating sheet product may also be applied to fibre-cement boards and elements, again affecting thermal insulation, moisture barrier, sound deadening, and/or other barrier properties.

In combination with a suitable adhesive, which is moisture resistant when cured, sheets of the thermally insulating product may be used in specialised applications as barrier membranes for showers, etc. By providing an exposed substrate on one face, which will typically be the outer face once installed as a barrier membrane, tiles may be bonded to the exposed substrate. Ideally the exposed substrate is water resistant, and may be coated with a suitable layer of water-resistant agent. This agent may be the same adhesive used for bonding the metallised film and substrate layers. One requirement of the agent is that it is compatible with tile adhesives, or at least those recommended for use. A range of water based and acrylic adhesives are available which are considered to be preferred choices for consideration in a barrier system such as discussed.

The sheet type thermal layer may be applied to materials used for constructing packaging containers. Such materials may include corrugated core cardboards, similar and fluted core plastic boards, solid cardboards, solid plastic sheets, etc. Again the thermal layer should be adhesively attached. A resulting container would not only possess improved thermal properties, but also improved resistance to delamination from condensation or damp contents. While boxes formed of card with metallised plastics films are known, they are susceptible to delamination and degradation upon exposure to condensation and moisture. Such containers under the present invention are more resistant to this, and even if there is damage to the outer card layer the water resistant thermal layers, and the face of the outer card to which it is attached, will remain intact.

Another variation of the present invention is the attachment of sheet type thermal insulating layers to standard insulating materials. This provides an alternative product with enhanced

insulating and other properties. The bonding of the present sheet type insulating layer to a standard insulating material may be direct, or a stiffening or strengthening intermediate may be used – e.g. a sheet of a panel material, to allow a cavity to be closed, or to span support elements.

- 5 For instance, a simple embodiment of this variant of the present invention may comprise a section of sheet material to which is directly attached an insulating material such as: expanded polystyrene sheet, or fibre batting (as opposed to loose fibre infill). These modified products may be used as substitutes for the other – e.g. an enhanced polystyrene sheet or higher R value may be used instead of standard expanded polystyrene sheet. Similarly, the enhanced batting material may be used instead of standard batting. However, apart from
10 improved thermal and other values, there are some other potential advantages for the improved product. For instance, the sheet backing can make the batting easier to handle but no more difficult to install. It also means less contact between the installer and the rough surface of the batt, which is an irritant when the batt is of glass fibre. Providing a thermal sheet backing on both major faces can also lessen contact during installation. Additionally,
15 however, it can also provide moisture barrier and potentially some improved noise reducing or deadening properties to the batting material.

- Even further, by extending a sheet backing larger than the area of the batting – e.g. by providing a margin around the batting area – the edges of the sheet backing can be stapled
20 or otherwise attached to building elements such as studs and joists etc to hold the product (with attached batting) in place. This allows this type of product to also be used on non-vertical surfaces, such as retrofitting insulation under timber-framed floors, and to the underside of ceiling joists and purlins etc. in commercial and domestic buildings – to provide a few examples. This technique is also applicable to expanded polystyrene and other
25 insulating materials to which the sheet may be bonded, thus improving their functionality.

- As mentioned previously, a stiffening or strengthening layer may be provided. Quite simply this may be a sheet or panel of a material such as a hardboard, mdf, etc. The sheet thermal insulating layer may be positioned between this panel and the additional insulating material, or the panel may be positioned between the two. Again, by providing a margin around the
30 additional insulating material, this type of embodiment can be used for closing off and insulating the underside of timber framed flooring, insulating ceilings and roof undersides, etc.

- As should be appreciated, the basic form of the invention as a sheet-like embodiment, allows a variety of new, novel embodiments to also be formed. The limited range of examples given
35 herein are meant to be representative only, and not limiting in any way. It is considered within the scope of the present invention as originally envisaged for the application of sheet type embodiments of the present invention to a variety of elements and structures to provide products of enhanced or new functionality.

DESCRIPTION OF DRAWINGS

- Figure 1a is an exploded schematic diagram showing the layers within a thermal insulation material according to a preferred embodiment of the present invention,
- 5 Figure 1b shows part of a sheet according to the embodiment of figure 1a, including perforations and microperforations,
- Figure 2 is an exploded schematic diagram showing the layers within a thermal insulation material according to an alternative preferred embodiment of the present invention,
- 10 Figure 3 is an exploded schematic diagram showing the layers within a thermal insulation material according to a further alternative preferred embodiment of the present invention,
- Figure 4 is a partial end section of an embodiment of an insulated plaster type board,
- Figure 5 is an end section of an embodiment of an insulated interlocking building
15 element,
- Figure 6 is an end section of an embodiment of an insulated lining element,
- Figure 7 is an end section of an embodiment of an insulated building moulding,
- Figure 8 is a partial end view of an embodiment using the present invention as a barrier or insulating membrane in a shower lining,
- 20 Figure 9 is a partial end view of an embodiment of a corrugated product for use in manufacturing packaging,
- Figure 10 is an end view of an embodiment including a supplementary insulating block,
- Figure 11 is a partial end view showing the use of various embodiments of the present invention under timber floor framing, and
- 25 Figure 12 is a side view of an embodiment of an insulated ceiling tile for use in suspended ceilings.

BEST MODES FOR CARRYING OUT THE INVENTION

- Manufacture of the thermal insulation material according to the present invention in a laminator enables the product to be manufactured in bulk and at low cost. Laminators are
30 known and available for dealing with paper and standard water-based adhesives, though have not been used in relation to aqueous type adhesives which are water-resistant when

set. However it has been found, and as exemplified in the examples herein, that such laminators can be used to produce sheet embodiments of the present invention.

Example 1

5 With reference to the drawings and in particular Figure 1, in a preferred embodiment (20) a thermal insulation material according to the present invention comprises a laminate of a first, paper-based substrate layer (1) sandwiched between two outer layers (2, 3). The outer layers (2, 3) are metallised plastics films, preferably with the metallised side of the films facing the paper-based substrate layer (1). An adhesive is applied between the paper-based substrate layer (1) and each metallised plastics film layer (2, 3).

10 The paper-based substrate layer (1) mainly consists of cellulose fibres such as wood pulp with a filler or binder added. The paper-based substrate layer may, for example, comprise a blend of semi-chemically treated hardwood (that is, pulp produced by mild-chemical treatment of the raw hardwood such that delignification is only partially accomplished so that the cellulose fibres are not completely separated) and Kraft paper/soft wood fibre. This helps
15 ensure that the laminate has high strength and an improved humidity performance. Preferably, the moisture content of the paper-based substrate layer is between about 8% to about 10% (inclusive) by weight after treatment.

The cellulose fibres within the paper-based substrate layer (1) may at least partly consist of recycled wood or paper or alternatively, could consist of 100% virgin cellulose fibres. The filler
20 or binder material comprises, for example, starch and/or clay and/or glue and may comprise between about 5% to about 25% of the total weight of the paper-based substrate layer.

The treatment applied to the paper-based substrate layer (1) may be a chemical treatment and/or a heat treatment. A chemical treatment may be applied to the substrate during the laminating process or it may be incorporated into the substrate during its manufacture.

25 I have found that "Semi-chemically treated paper" having a weight of about 160gsm (gram per square metre), manufactured by Carter Holt Harvey in New Zealand, is a particularly suitable material for the paper-based substrate layer (1).

The metallised plastics film layers (2, 3) may for example comprise metallised polyester film having a thickness of about 12µm and/or a weight of about 17gsm. In order to increase the
30 bonding strength between the paper-based substrate layer (1) and each metallised plastics film layer (2, 3), the surface of the metallised plastics film adjacent to the paper-based substrate layer (1) may be treated to effectively increase its surface area. Various forms of treatment are available to accomplish this, including corona treatment and chemical etching.

The adhesive used to bond the metallised plastics film layers (2, 3) to the paper-based
35 substrate layer (1) is water-based and, when cured, is water resistant or waterproof. The active ingredients within the adhesive should be compatible with the treatment applied to the

paper-based substrate layer (1) to ensure an active bond is achieved between the metallised plastics film layers (2, 3) and substrate layer (1).

Substrate

The substrate used was manufactured by Carter Holt Harvey of Auckland, New Zealand and sold under the trade mark CLIMATE PERFORMANCE MEDIUM. This substrate is referred to as a semi-chemically treated medium and has the following specifications:

Furnish targets:

25% Mid Kappa Kraft pulp

35% NSSC pulp

10 10% Broke

15 30% Recycled fibre (NCC/OCC)

Where:

Kappa = a measure of the amount of lignin remaining in the pulp after treatment

NSSC = Neutral Sulphite Semi-chemical treated

15 Broke = paper discarded at any stage during the manufacturing process which is usually repulped

NCC/OCC = New Corrugated Containers/Old Corrugated Containers

The pulp component of the substrate includes both plantation-grown *Pinus Radiata* (having long and strong cellulose fibres) Kraft pulp and semi-chemical hardwood pulp from virgin Australian hardwood (having short cellulose fibres). The chemical treatment of at least the hardwood pulp includes both Sodium Hydroxide and Sodium Sulphite as main ingredients. The substrate used also had the following specifications:

The substrate used also had the following specifications:							
Grammage	Moisture content	Thickness	Concorra Crush		SCT (STFI)		RCT
g/m2	%	Typical pm	N MD	Minimum	kN/m CD	Minimum	N
160	9.0	210	500	430	3.6	2.9	335

It is considered that a sodium-based chemical treatment to the substrate can improve the bonding reaction between the adhesive and the substrate (or at least when some of the cellulose fibres treated in the sodium-based treatment) contributing to improved moisture resistance in the finished laminate.

Adhesive

The adhesive used was manufactured by Henkel New Zealand Limited of Auckland, New Zealand and is identifiable by their code Z9886HV. The adhesive is a waterborne synthetic resin having a methacrylic acid base and the following ingredients:

- 5 The adhesive itself had a viscosity (Sp4,5orpm,@20°C) of between 400-700 cps, a pH of between 7.0 and 9.4 and once cured, a very high water resistance and high (180°C intermittent exposure) heat resistance.

Chemical entity	Proportion
Poly (2-chloro-1,3-butadiene/methacrylic acid)	>50%
Ethanol	<0.5%
Surfactants	<0.2%
Preservative	<0.5%

Plastics Film

- 10 The plastics film layers were provided by metallised polyester film having a thickness of about 12µm and a weight of about 17g/m². The surface of the metallised plastics films adjacent to the substrate was chemically treated (etched). The metallised surface of the films were positioned adjacent to the substrate. The grade of polyester film used had a MVTR (Moisture Vapour Transition Rate) of 0 meaning that water molecules are unable to pass therethrough and in practice, water molecules are unable to cling to the plastics film.

15 Example 1a

- Manufacture of a thermally insulating sheet material according to example 1 of the present invention is preferably accomplished in a laminating machine such as a standard wet (that is, incorporating an adhesive bonding process rather than heat-bonding) laminating machine in order to produce a continuous strip of finished product. The laminator is a machine into which is fed the individual lengths of films or webs of paper-based substrate (1) and metallised plastics (2, 3). The sheets or films are fed between or over rollers which selectively heat and/or combine the various layers, some of which have had adhesive applied thereto as mentioned above. Heat is introduced into the laminator by for example gas or over dryers in order to activate or set the adhesive. The speed and temperature at which the laminator is run is dependent upon the type of laminator but the temperature may range between for example 60°C and 170°C, while the speed may range between 100m/min to 500m/min. At higher laminator speeds it is generally necessary to increase the laminator temperature. As an example, for a 1200mm wide strip of product, the laminator speed may be about 100m/min and the temperature about 60°C.

The metallised plastics films (2, 3) may be pre-treated (for example, corona treated or chemically etched) or this treatment may be carried out prior to entry of the films to the laminator or within the laminator. Similarly, the paper-based substrate layer (1) may be purchased pre-treated, or a chemical treatment may be applied prior to entry of the substrate to the laminator or within the laminator. Ordinarily, the application of adhesive to the metallised plastics films (2, 3) is carried out prior to entry of the films to the laminator or within the laminator.

A layer of about 5g/m² of this adhesive was applied to each side of the substrate within 1 to 4 seconds of lamination with respective plastics film layers in a standard wet laminator operating at about 60°C. The resulting laminate was formed into a roll and allowed to cool.

The thickness of the completed sheet of thermal insulation material, after laminating according to such a method, is typically between about 0.5mm and about 1 mm.

As the finished product leaves the laminator it is still at an elevated temperature but because the product has a relatively low heat storage capacity, it may be formed into rolls directly from the laminator output. It can then be left to cool and the adhesive to set before it is used.

The resulting laminate was tested by the Australian National University and found to:

- have an R value of 3.8
- be mould and mildew resistant (MVTR rating of 0)
- be heat resistant (low ignition rate)
- provide high radiation resistance protection
- be weather and moisture proof
- be resistant to vermin
- be non-allergic
- be non toxic
- remain stable (for example, after 48 hours submerged in water the product did not delaminate).

Examples 2

As shown in Figure 2, in an alternative embodiment, the finished product could comprise a single outer layer of metallised plastics film (2) bonded (as described above) to a paper-based substrate layer (1). Furthermore, as shown in Figure 3, in a further alternative embodiment an additional reinforcing layer (4) may be incorporated into the thermal insulation material. Reinforcing layer (4) may comprise for example a plastics film or mesh of increased tensile strength and/or tear resistance. The reinforcing layer (4) may, for example, comprise a mesh of silk, fibreglass, plastic and/or nylon strands. However, it should be noted that even without an additional reinforcing layer (4), the product of the present invention is sufficiently strong for most uses.

As the laminate may be impenetrable to moisture (due to the polyester film), once the substrate has been manufactured it may be subjected to a perforation step wherein large (6) or tiny perforations (5) (e.g. "pin-hole" sized) are made in the laminate at regular intervals along its length and across its width. This would preferably be carried out after lamination has occurred but prior to the laminate being formed into a roll. The perforations allow moisture to pass through the laminate though by making the perforations very small it is not anticipated that they will provide a major point of entry for water to the substrate. In any event, the substrate/film bond is not susceptible to water ingress.

The use of micro-perforations of typically 150mil maximum size and 20mil or less average diameter, can instead be considered and employed. The use of micro-perforations can allow the sheet material to breath and allow water vapour to progress through the sheet, while still acting as a barrier to liquid water and minimising heat loss from air flow.

Example 3

This example comprises an insulated wall board panel of the type typically comprising a plaster based core (46) faced with paper sheet linings (44, 45). These are commonly sold in New Zealand under the Gib® brand, and under various brands overseas.

To one paper face (44) is adhesively bonded a thermal insulating sheet (40) comprising outer metallised plastic film faces (41, 43) and internal substrate (43), substantially as described in example 1. The same adhesive as used to bond the films (41, 43) to the substrate (43) may be used to bond the insulating sheet (40) to the paper face (44) of the plaster board. This paper face (44) may be modified to be of a similar material to the substrate (42), or substituted by other materials.

Various manufacturing processes may be used. For instance the insulating sheet (40) can be applied to an already manufactured plaster board, or alternatively the thermal insulating sheet (40) may already be bonded to the lining (44) before they are applied to the plaster core (46) during manufacture of the board. In other variations, the substrate (42) may form the plaster board lining, with layers (43 and 44) absent in the illustration of figure 4.

Example 4

This example represents an interlocking building element (50) comprising two spaced apart outer wall members (51, 53) of solid timber. Spacers (52) at intervals connect the members (51, 53). To an inner face of at least one member (53) is present a thermal insulating sheet (54) of a type such as described in example 1. This may be adhesively bonded to the inner face of the wall member (53) during construction of the element (50), which is preferable to mechanical fastening (such as staples, etc.) as it enables the interlocking element (50) to be cut to length during use, without any significant damage to the bonded backing (54).

A variety of construction adhesives may be used for bonding the thermal insulating layer (54), the preference being for an adhesive which is moisture resistant when cured.

Example 5

5 This example represents an overlapping or interlocking lining element, such as may be used for cladding, flooring, ceiling or wall linings etc. Illustrated is a timber lining element (60) with a ship-lap profile. It should be appreciated that the same principles may be applied to other profiles, such as T&G, and that the element (61) may be made of other materials, including plastics, fibre cement, reconstituted wood, etc.

10 To the rear face of the element (61) is provided a lining (62) of a thermal insulating material such as described in example 1. This may be adhesively bonded, such as described in example 4. The lining may optionally be extended (63) to cover the overlapping portion of the element (61), though would generally be omitted on T&G type arrangements (depending on the tolerances in the fitting of the tongue in the groove).

15 This product is particularly useful for use where cavities may not exist for in-fill type insulation materials, or replacing existing uninsulated elements during renovations.

Example 6

20 This example represents use on various mouldings and architraves, etc. These are particularly useful for improving insulation at intersections of walls, ceilings, and floors etc. Illustrated is one particular profile of a scotia moulding (70). This may be of paper lined plaster, plaster, mdf or reconstituted wood, timber, etc. To the rear face is adhesively bonded a thermally insulating lining (71), such as described in example 1. The same general techniques for bonding the lining (71) to the element (70) as previously discussed for plaster boards (example 3) or timber and wood (example 4) may be used as appropriate.

Example 7

25 This example illustrates use as an insulating barrier layer in shower construction. The drawing is deliberately simplified for ease of viewing, and shows a wallboard (80) attached to timber framing (81) as per normal construction practice.

30 Over the wallboard (80) is adhesively applied a thermal insulating layer (84) such as described in example 1. This may be applied by using a construction adhesive which is water proof when cured, the adhesive being brushed, sprayed or rolled on. Alternatively a permanent adhesive backing may be applied to the insulating layer (84), preferably with a protective backing (not shown).

35 The outer face of the insulating later (84) (when applied to the wallboard (80)) is ideally compatible with tile adhesive. A variety of acrylic water based adhesives are available, which can be applied (82) over the insulating layer (84) for affixing the tiles (83). Optionally the

insulating layer may have an exposed outer substrate layer, which is ideally treated to render it water resistant, for application of the tile adhesive. Another option is to provide a primer coating to increase adhesion between the tile adhesive and insulating layer (84). Suitable combinations of compatible primers and adhesives may be selected based on
5 manufacturer's data sheets and recommendations.

Example 8

This example illustrates a sheet product (90) which may be used for constructing boxes and containers for produce, chilled or heated items, etc. Here there is an insulating layer (95) comprising metallised film layers (91, 93) sandwiching a substrate (92) and substantially as
10 described in example 1.

Attached to an outer face of one of the layers (93) is a corrugated core (94) and a final face layer (96), typically of the same material as the core (94). These additional layers (94, 96) may be bonded as additional steps in the manufacturing process for the insulating layer (95), so that the product can be manufactured in substantially a single manufacturing process.

15 As an alternative, the insulating layer (95) can be adhesively bonded to an existing corrugated board which has already been manufactured. It should also be appreciated that this embodiment may also be used for non-corrugated core cards, plastic fluted boards, etc. Use of the sheet product may also be for applications other than the construction of boxes, and may be an insulating material in its own right for use in building construction and other
20 applications.

Example 9

In this example is described an enhanced insulating product (100), comprising a sheet insulating layer (101) such as described in example 1, to which has been adhesively bonded a block or batt of insulating material (102). This insulating material (102) may be glass fibre
25 batting, an expanded polystyrene block, or other materials. By extending the sheet (101) past the edges of the block (102) is formed a margin (103) which can be used to staple the sheet (101) to studs, joists, battens etc. during installation. The product is a potential alternative to glass fibre batting products, allowing less direct contact with the batting material during installation. It is also particularly amenable to installation on the underside of
30 structures, such as under flooring, and roofs, etc.

Figure 11 illustrates a modified embodiment of that of figure 10, in that the insulating layer (114) (equivalent to (101) in figure 10), while bonded to an insulating material (116) on one side, is also attached to a stiffening panel 115 on the other side. This may be of a material such as a reconstituted wood product (e.g. hardboards, mdf, etc.), plaster boards, fibre
35 cement boards, etc. though may comprise other materials as the application demands. It may even comprise a decorative element such as a ceiling tile, etc.

In figure 11 the element (110) is mechanically attached to flooring joists (111) under a floor (112). This element (110) is particularly useful for insulating the underside of timber framed floors, though may find application in other areas of construction. The thermal insulating layer (117) may also be draped across the top of the joists (111) prior to installation of the flooring layer (112) as per standard practices in some jurisdictions. Most such installations require a perforated or breathable insulating layer (117) and thus perforate or breathable embodiments may be used.

Example 10

This example illustrates a ceiling tile (120) for use in suspended ceilings though may also be applied to other decorative and finishing elements. Here a thermal insulating layer (121), such as described in example 1, is attached to a major face of the tile element 122. This produces a thermally insulated ceiling tile able to help prevent heat loss into ceiling cavities.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the spirit or scope of the present invention as described herein and with reference to the appended claims.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinence of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

WHAT WE CLAIM IS:

1. A thermal insulation product comprising:
a metallised plastics film layer and
a substrate which is absorbent to a moisture resistant adhesive, which is resistant to moisture after curing, said adhesive being used for bonding said metallised plastics film layer to a major face of the substrate,
the arrangement being further characterised in that there is penetration of adhesive into the substrate to increase or supplement at least either or both of its surface and edge moisture resistance properties.
2. A thermal insulation product as claimed in claim 1, in which the substrate is a sheet material.
3. A thermal insulation product as claimed in either claim 1 or claim 2, in which the substrate is a fibrous material.
4. A thermal insulation product as claimed in any one of the preceding claims, in which the substrate is a paper-based substrate layer containing cellulose fibres.
5. A thermal insulation product as claimed in either claim 3 or claim 4 in which the substrate has been treated to enhance its resistance to degradation by moisture.
6. A thermal insulation product as claimed in claim 5 in which the treated substrate is absorptive to an adhesive which is water based.
7. A thermal insulation product as claimed in claim 4 in which the substrate comprises a maximum of 50% of recycled paper material.
8. A thermal insulation product as claimed in claim 7 in which the recycled paper material substantially comprises recycled paper material that has been recycled only once.
9. A thermal insulation product as claimed in claim 4 in which the substrate comprises substantially 100% virgin cellulose fibre.
10. A thermal insulation product as claimed in any one of claims 4 through 9 which includes a filler or binder material comprising at least one of clay, starch, and glue.
11. A thermal insulation product as claimed in claim 10 in which there is present between 5% to 25% inclusive, by weight, of filler or binder material.
12. A thermal insulation product as claimed in any one of the preceding claims in which the mass of the substrate layer is between 50gsm and 500gsm inclusive.
13. A thermal insulation product as claimed in any one of the preceding claims in which the mass of the substrate layer is between 100gsm and 200gsm inclusive.

14. A thermal insulation product as claimed in any one of the preceding claims in which the metallised plastics film comprises a metallised polyester film.
15. A thermal insulation product as claimed in any one of the preceding claims in which the plastics film of the metallised plastic film is metallised on one side, and either corona or chemically treated on the other side.
16. A thermal insulation product as claimed in any one of the preceding claims in which the metallised plastics film layer has a thickness of between about 10µm and about 15µm
17. A thermal insulation product as claimed in any one of the preceding claims in which the mass of the metallised plastics film layer is between 15g/m² to 20g/m² inclusive.
18. A thermal insulation product as claimed in any one of the preceding claims in which there is bonded to one side said substrate a reinforcing material.
19. A thermal insulation product as claimed in claim 18 in which the reinforcing material is a fibrous or mesh material.
20. A thermal insulation product as claimed in claim 19 in which the reinforcing material contains at least one of glass fibres, silk, or synthetic fibres.
21. A thermal insulation product as claimed in claim 20 in which said fibres possess a high tensile strength.
22. A thermal insulation product as claimed in any one of claims 18 through 21 in which said reinforcing material is positioned between a said metallised plastics film layer and the substrate to which it is adhesively bonded.
23. A thermal insulation product as claimed in any one of the preceding claims in which the adhesive is a water borne synthetic resin.
24. A thermal insulation product as claimed in claim 23 in which the adhesive has a methacrylic acid base.
25. A thermal insulation product as claimed in claim 24 which is a Poly (2-chloro-1 ,3-butadiene/methacrylic acid) resin.
26. A thermal insulation product as claimed in any one of the preceding claims in which between 4g/m² to and 6g/m² inclusive of adhesive is applied between a metallised plastics film layer and substrate.
27. A thermal insulation product as claimed in any one of the preceding claims in which there is adhesively bonded a metallised plastics film layer to both alternate major faces of a substrate.

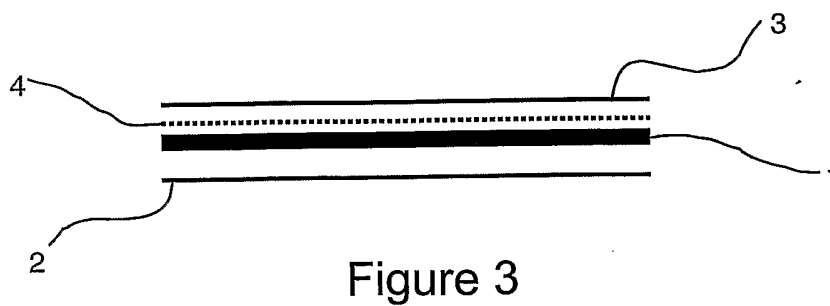
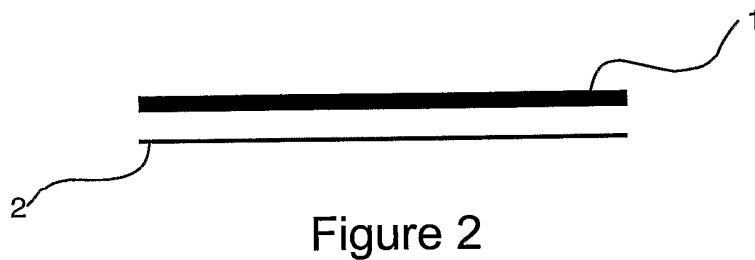
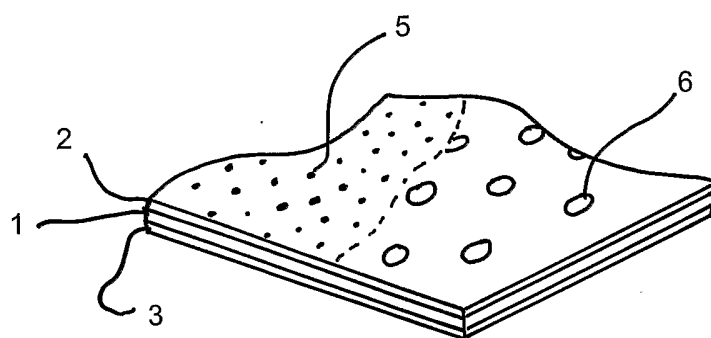
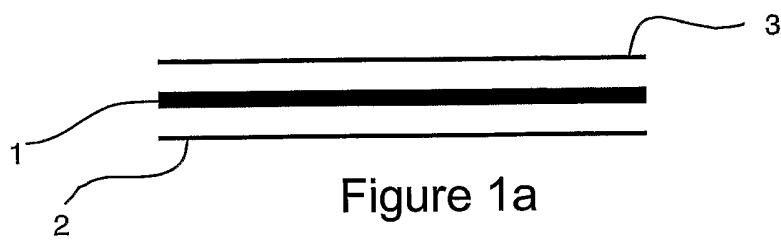
28. A thermal insulation product as claimed in any one of the preceding claims which is permeable to water vapour.
29. A thermal insulation product as claimed in claim 28 in which at least metallised plastics film layers are perforated.
30. A thermal insulation product as claimed in claim 29 in which at least some of said perforations are micro-perforations.
31. A thermal insulation product as claimed in claim 30 in which the average diameter of the micro-perforations is 20 microns or less.
32. A thermal insulation product as claimed in claim 30 in which the maximum diameter of a micro-perforation is 125 mils.
33. A thermal insulation product as claimed in any one of the preceding claims in which there is adhesively bonded a metallised plastics film layer to both alternate major faces of a central substrate.
34. A thermal insulation product as claimed in any one of the preceding claims which comprises multiple alternating bonded layers of metallised plastics film and substrate, there optionally being reinforcing materials included within the structure.
35. A thermal insulation product as claimed in any one of the preceding claims in which said product is in roll form.
36. A thermal insulation product as claimed in any one claims 1 through 34 which is bonded to a building element.
37. A thermal insulation product as claimed in claim 36 in which said building element comprises a gypsum type wall board.
38. A thermal insulation product as claimed in claim 36 in which said building element comprises a member of a group comprising: a concrete block, a brick, a construction block, a prefabricated concrete structure, a tile, a ceiling tile, a flooring tile, a wall tile.
39. A thermal insulation product as claimed in claim 36 in which said building element comprises a member of the group comprising: a wall board, a shower-lining board, a construction board, a sheet of plywood, a board of reconstituted wood or fibre material, a glass panel, a plaster board or sheet, a fibrous cement board or sheet, a sheet of plastics laminate, a metal sheet, a board of at least part metal construction.
40. A thermal insulation product as claimed in claim 36 in which said building element comprises a member of the group comprising: a door, a door panel, a wall panel, a floor panel, a ceiling panel, a panel of semi-hollow or hollow construction.

41. A thermal insulation product as claimed in claim 36 in which said building element comprises a member of the group comprising: a length of timber, a timber board, a prefabricated interlocking timber construction element, a timber lining material.
42. A thermal insulation product as claimed in any one claims 1 through 34 which is attached to a supplementary insulating material.
43. A thermal insulation product as claimed in claim 42 in which the insulating material comprises a member of the group comprising: a panel or sheet of an expanded polystyrene, a panel or sheet of an expanded insulating material, a panel or sheet of an expanded fibrous or spun material, a batt of an expanded fibrous material, a batt of an expanded glass fibre insulating material.
44. A thermal insulation product as claimed in claim 42 or claim 43 in which there is included a stiffening element.
45. A thermal insulation product as claimed in claim 44 in which the stiffening element is a sheet of a material.
46. A thermal insulation product as claimed in claim 44 or claim 45 in which the arrangement of components comprises at least one of:
 - a said stiffening element is intermediate the supplementary insulating material and a thermal insulation product as defined in any one of claims 1 through 34;
 - a thermal insulation product as defined in any one of claims 1 through 34 is intermediate the stiffening element and supplementary insulating material.
47. A thermal insulating product in the form of an adhesive tape or sheet, said tape or sheet comprising a thermal insulating product as claimed in any one of claims 1 through 34 in combination with a tacky or activatable adhesive layer.
48. A thermal insulating product as claimed in claim 47 in which there is an intermediate protective layer between the tacky or activatable adhesive layer and the thermal insulating product as claimed in any one of claims 1 through 34.
49. A thermal insulating product as claimed in either claim 47 or claim 48 in which there is a removable backing layer protecting the tacky or activatable adhesive layer.
50. A thermal insulating product as claimed in any one of claims 47 through 49 in which there is an intermediate heat shielding layer between the tacky or activatable adhesive layer and the thermal insulating product as claimed in any one of claims 1 through 34.
51. A thermal insulating product as claimed in any one of claims 47 through 50 when used as a lagging for pipes or conduits.

52. A thermal insulating tape in the form of a tape for use in stopping joints between wallboard panels, said tape comprising a thermal insulating product as claimed in any one of claims 1 through 34 wherein one or both outer surfaces comprises a substrate layer absorbent to stopping compound.
53. A thermal insulating tape as claimed in claim 52 in which one outer surface comprises an adhesive suitable for bonding the tape to wallboard panels.
54. A thermal insulating product as claimed in any one of claims 1 through 46 when used in either of both of building construction or renovations.
55. A thermal insulating product as claimed in any one of claims 1 through 34 or claims 47 through 53 which is manufactured by lamination in a continuous strip.
56. A method of manufacturing a thermal insulating product, as claimed in any one of claims 1 through 34, said method comprising:

feeding continuous lengths of substrate and of metallised plastics film to a laminator and adhesively laminating the metallised plastics film to the substrate to form a continuous strip of thermal insulation material.
57. A method as claimed in claim 56 in which the adhesive is introduced to either or both a metallised plastics film and substrate prior to the combination.
58. A method as claimed in claim 56 or claim 57 in which heated rollers are used to assist curing of the adhesive.
59. A method as claimed in any one of claims 54 through 56 in which the lamination process is operated to produce a thermal insulating product at a linear speed of between 100m/min and 500m/min inclusive.
60. A method of manufacturing a thermal insulating product comprising introducing to either or both of a metallised plastics film layer and a substrate which is absorbent to a moisture resistant adhesive, a curable moisture resistant adhesive for bonding same; said layers then being brought into close face to face contact such that there is penetration of adhesive into the substrate to increase or enhance at least either or both of its surface and edge moisture resistance properties, curing of the adhesive being optionally accelerated by heating.
61. A thermal insulating product, or a product comprising same, produced from a method as claimed in claim 60.
62. A thermal insulating product, substantially as described herein with reference to the contained examples and accompanying drawings.

63. A method of manufacturing a thermal insulating product, substantially as described herein with reference to the contained examples.



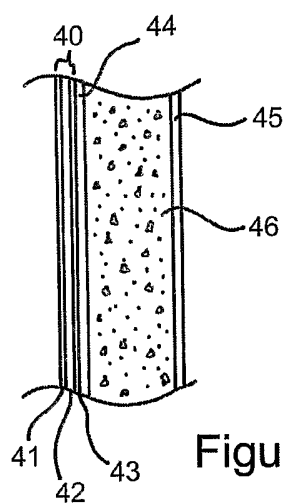


Figure 4

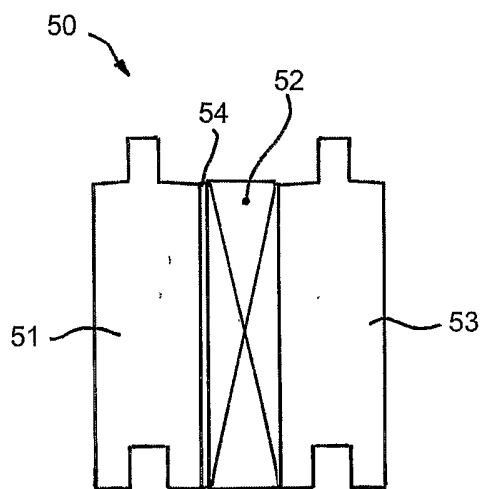


Figure 5

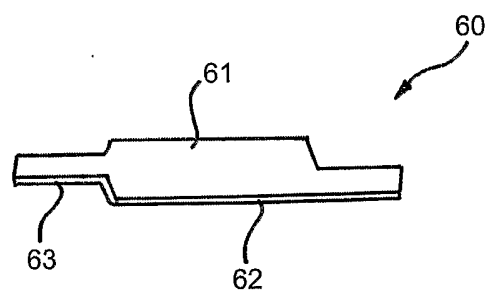


Figure 6

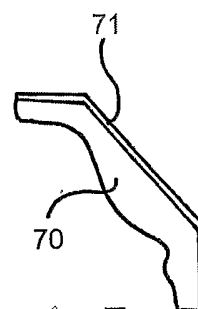


Figure 7

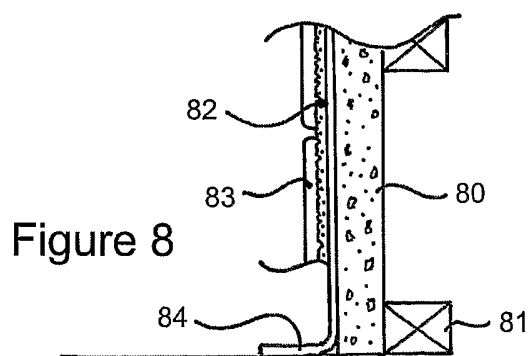


Figure 8

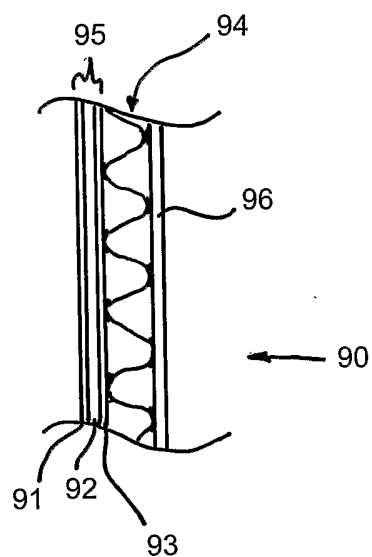


Figure 9

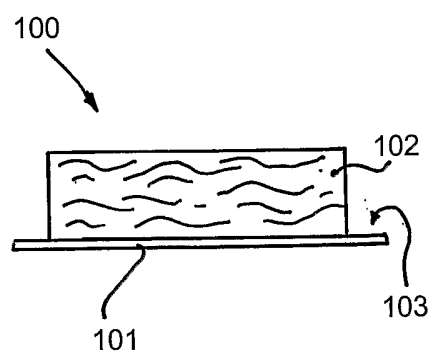


Figure 10

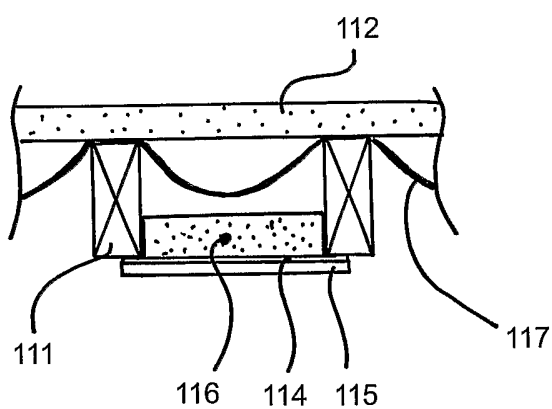


Figure 11

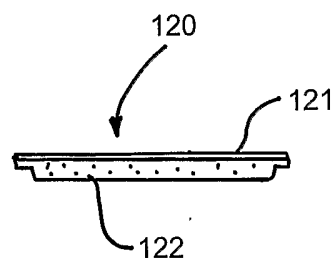


Figure 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2005/000213

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁷ : E04B 1/78, B32B 29/00, F16L 59/00, 59/02. According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC: Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU IPC: Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI: ((INSULAT+) AND (ADHESIV+ OR GLUE+ OR BOND+) AND (PLASTIC+ OR POLYMER+ OR FILM+) AND (MOIST+ OR WET+ OR DAMP+ OR HYDROPHOBIC+) AND (REPEL+ OR RESIST+ OR PREVENT+ OR PROTECT+))		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 1999 039059 A (OWENS CORNING) 5 August 1999. See entire specification.	
A	WO 2000 057101 A (ROCKWOOL LAPINUS B.V.) 29 September 2000. See entire specification.	
A	WO 2001 019610 A (TEXTILES COATED INC) 22 March 2001. See entire specification.	
☒ Further documents are listed in the continuation of Box C ☒ See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 28 November 2005		Date of mailing of the international search report 30 NOV 2005
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer R. WEBER Telephone No : (02) 6283 2546

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2005/000213

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004 016427 A (STEENTJES) 26 February 2004. See entire specification.	
A	DE 29615684 U (GRUNZWEIG & HARTMANN A.G.) 12 December 1996. See entire specification.	
A	AU 68754/94 (657459) B (CARTER HOLT HARVEY BUILDING PRODUCTS GROUP LIMITED) 9 March 1995. See entire specification.	

Information on patent family members

International application No.

PCT/NZ2005/000213

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	1999 039059	AU	24854/99	CA	2316803	CN	1289384
		EP	1051553	US	6083603		
WO	2000 057101	AU	29489/00	EP	1163470	HU	0201293
		PL	350733				
WO	2001 019610	AU	70982/00	CA	2382876	EP	1240013
		US	2001030023				
WO	2004 016427	AU	2002100347	AU	2003250594		
DE	29615684	CZ	9702833	EP	828040	PL	321946
AU	68754/94	NZ	248286				

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX