An impact resistant shingle is provided, wherein the base mat is impregnated with an asphaltic material, with an asphaltic material on the upper surface of the shingle, and wherein another asphaltic material is disposed on the rear surface of the shingle, which other asphaltic material is softer with greater elongation than the asphaltic material used elsewhere in the shingle, such that crack resistance is afforded because energy from impact on the shingle is dissipated.
Fig. 4
Fig. 5 PRIOR ART

Fig. 5A
Fig. 7
IMPACT RESISTANT SHINGLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation-in-part of U.S. application Ser. No. 10/871,911, filed Jun. 18, 2004, which in turn is a continuation of Ser. No. 10/288,747, filed Nov. 6, 2002, the complete disclosures both of which is herein incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] It is known in the shingle art that today’s shingles are generally made of a base mat of fibrous construction, most usually of fiberglass construction, that is impregnated with an asphaltic material. The asphaltic material, generally bitumen, of some formulation is disposed on the upper surface of the base mat, and serves to adhere a layer of mineral granules into the asphaltic material on the upper surface of the base mat. Generally such occurs over the entirety of the upper surface of the shingle, but, such mineral granules can, if desired, be applied only to a visible portion of the upper surface of the shingle, to be visible in the installed condition, and to be subject to elements of weather in the installed condition.

[0003] Generally, the rear or lower surface of the shingle also has a layer of asphaltic material, and usually has a fine layer of mineral granules, such as sand, talc, mica, or other mineral granules disposed on the lower surface of the shingle.

[0004] It has been found that when shingles that have been installed on a roof are subjected to various kinds of impacts, such as falling tree branches, workman walking on the shingles, or hail stones striking the shingles, especially during cold weather conditions, cracks can develop in the lower surface of the shingle as a result of such impacts.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to an impact resistant shingle, in which an asphaltic material impregnates the base mat of the shingle and the upper surface of the shingle, but wherein an additional layer of a modified asphaltic material, having greater ability to resist cracking than that of the principal asphaltic material and being softer than the principal asphaltic material, is provided, such that the softer asphaltic material is on the rear surface of the shingle that faces the roof on which the shingle is to be applied. When impacts from hail stones, tree branches, walking, or any other impacts are applied against an upper surface of a shingle that is installed on the roof, the softer asphaltic material on the rear surface of the shingle provides a means for dissipating at least some of the impact, whereby crack formation on the lower surface of the shingle is avoided. The modified asphaltic material should have the ability to dissipate mechanical energy. A polymer modified asphalt can have such ability, such that it can resist cracking because it yields or flexes when sharply struck, rather than fracturing.

[0006] Accordingly, it is a primary object of this invention to provide a shingle having a softer, impact-resistant layer of modified asphaltic material on its lower surface, that has a greater ability to resist cracking and a greater ability to dissipate energy under conditions in which the upper surface of the shingle is subjected to impact, than the other asphaltic material that is used in the manufacture of the shingle.

[0007] It is another object of this invention to accomplish the above object, wherein a layer of reinforcing material is applied to the rear surface of the shingle.

[0008] Other objects and advantages of the present invention will be readily apparent to those skilled in the art from the reading of the following brief descriptions of the drawing figures, the detailed descriptions of the preferred embodiments, and the appended claims.

[0009] Thus, the present invention is directed toward providing a modified asphaltic material on the lower surface of the shingle, below the base mat, and preferably just above or below the layer of sand, talc, mica or other fine mineral application to the shingle or an application of a fabric, paper, film, scrim or the like, such that the asphaltic material applied to the lower surface of the shingle, being softer, has an ability to resist cracking and an ability to dissipate energy to a greater extent than the asphaltic material that generally comprises most or all of the asphaltic material used in the rest of the shingle.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0010] FIG. 1 is a front view of a shingle, showing multiple tabs separated by spaced apart slots, with mineral granules disposed on the upper surface of the shingle.

[0011] FIG. 2 is a horizontal sectional view, taken through the shingle of FIG. 1, generally along the line of II-II of FIG. 1.

[0012] FIG. 2A is an illustration similar to that of FIG. 2, but wherein a release liner is shown on the rear surface, instead of fine granules.

[0013] FIG. 3 is a horizontal sectional view, similar to that of FIG. 2, but taken through a shingle having a layer of modified asphaltic material spaced from the base mat by a layer of harder asphaltic material, but otherwise being similar to the illustration of FIG. 2.

[0014] FIG. 3A is an illustration similar to that of FIG. 3, but wherein a release liner is shown on the rear surface, instead of fine granules.

[0015] FIG. 4 is a rear plan view of the shingle of each of FIGS. 1, 2 and 3, taken along the lines IV-IV of FIGS. 2, 2A, 3 and 3A (in the case of FIGS. 2A and 3A, after removal of the release liner), wherein a wind and/or crack-resistant layer of reinforcing material is applied to the lower, or rear surface of the shingle, and adhered thereto.

[0016] FIG. 5 is a representation of a fragmentary rear view of a shingle of prior art type, in which the asphaltic material on the rear surface of the shingle displays a crack formation of a type resultant from impact on the opposite, or upper, front surface of the shingle.

[0017] FIG. 5A is a representation of a fragmentary illustration of the rear or lower surface of a shingle similar to that of FIG. 5, but wherein the shingle of FIG. 5A has a modified asphaltic material on its rear surface, such that, after impact, no crack formation is illustrated.
FIG. 6 is a photographic representation of a rear view of a shingle of prior art type, in which the asphaltic material on the rear surface of the shingle displays a crack formation of a type resultant from impact on the opposite, or upper, front surface of the shingle.

FIG. 6A is a photographic representation of the rear or lower surface of a shingle, similar to that of FIG. 6, but wherein the shingle of FIG. 6A has a modified asphaltic material on its rear surface, and a reinforcement layer, for example a scrim layer, such that, after impact, no crack formation is illustrated.

FIG. 7 is a vertical sectional view, taken through an alternative embodiment of a shingle of this invention, wherein a two-layer laminated shingle is illustrated, with each layer of shingle material being constructed like the illustration of FIG. 2.

FIG. 8 is a schematic illustration of the manner in which the layer of modified asphaltic material is applied to an otherwise-formed shingle, during the manufacturing process, by moving the shingle across an asphalt-applying roller.

FIG. 9 is a schematic illustration of another method of applying a layer of modified asphaltic material to an otherwise-formed shingle, wherein the softer layer is applied as an already-formed layer of material.

DETAILED DESCRIPTIONS OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail, reference is first made to FIG. 1, wherein a shingle is shown, generally designated by the numeral 10. The shingle 10 is comprised of an upper headlap portion 11 and lower tab portions 12, with the tab portions being four in number. The various tab portions 12 are spaced apart by slotted openings 13.

The upper headlap portion 11 is that which is disposed above the upper ends of the slotted openings. Left and right edges 15 and 16, respectively, of the shingle 10 have partial cut-outs 15a and 16a, respectively, such that when shingles 10 are aligned left-to-right, portions of slotted openings 15a and 16a will come together forming full slotted openings.

With reference to the shingle of FIGS. 2 and 2A, the shingle 10 has respective upper and lower surfaces 7, 8 and is comprised of a base mat 17 of preferably fiberglass mat construction, although the same can be comprised of organic mat, or fibered polymeric mat construction (or a construction comprised of combinations thereof), if desired. The mat 17 is impregnated with a first asphaltic material 18, typically having a softening point between about 100°F and 160°F when used with an organic mat and between about 190°F and 240°F when used with a fiberglass mat. The asphaltic material 18 preferably has a hardness as measured by penetration at 77°F greater than about 30 dmm when used with an organic mat and a hardness greater than about 18 dmm when used with a glass mat. Disposed above the impregnated mat 17, 18 is a layer of asphaltic material 20 which, may or may not be of the same asphaltic material construction as the asphaltic material 18. If desired, the asphaltic materials 18, 20, may be comprised of a single layer.

Irrespective of whether the asphaltic materials 18 and 20 are comprised of a single layer, or of multiple layers, there will normally be disposed on the upper surface of the shingle, a layer of mineral granules 21, which can, if desired, serve to deflect heat, infrared radiation, and ultraviolet rays, and which can provide a desired color or pigmentation to the shingle 10.

Below the asphaltic impregnated mat 17, 18, there is provided an additional layer of asphaltic material that is a modified asphaltic material, designated by the numeral 22. The asphaltic material layer 22 is asphaltic material that is modified relative to the asphaltic materials 18, 20, to be softer, having greater ability than the asphaltic material 18, 20 to dissipate energy and resist cracking at the temperatures normally encountered on a roof, regardless of the ambient weather conditions, and regardless of the climate in which the roof is disposed. The softness of the softer or modified asphaltic material 22 can also be referred to as having a lower elastic modulus than that of the asphaltic materials 18, 20.

The layer 22 of modified asphaltic material can be provided directly to the asphalt impregnated mat 18, or to another intermediate coating of asphaltic material that has been applied to the impregnated mat 18, via lick-on, roll-on, fused powder-coating or spray-on techniques, or otherwise, as may be desired. More than one impact resistant layer or a number of dissipative layers 22 may be used.

Preferably, the layer 22 of modified asphaltic material underlies the entire lower area of the shingle 10, or at least underlies the entire exposed portion of the shingle.

The modified asphaltic material of layer 22 should not be so soft as to create problems of sticking to an adjacent shingle when shingles are stacked together under warm conditions; however, such a concern, should it arise, could be alleviated by a layer 23 of fine granules, such as sand, talc, mica or the like, or alternatively, a release paper, or liner 23a, other parting agent or layer of fabric, paper, plastic film or the like optionally applied beneath the layer 22, for assuring separation between adjacent stacked shingles. The layer 23 or 23a could be permanently or temporarily adhered thereto. The layer 22 of modified asphaltic material can optionally have self-adhesive properties for allowing the product to be adhered to a roofing substrate. In such an embodiment, the layer 22 will preferably be provided with a release paper or tape 23a, or other parting agent, to allow stacking of the shingles prior to adhering them to a roofing substrate, after removal of the release agent to expose the self-adhesive layer 22.

The modified asphaltic material of layer 22 will preferably have a finite yield point and viscosity that is sufficiently high that the material 22 does not flow when in a packaged state, nor when shingles 10 are installed on a steep-sloped roof in hot, sunny weather when they can be subjected to internal or surface temperatures in the range of 140°F to 180°F.

In the present invention, the modified asphaltic material 22 preferably has greater elongation or extensibility than the material 18. The improved elongation is preferably exhibited even at low temperatures, such as, for example, 30°F. The improved elongation can be a result of the presence of additives which also enhance the ductility at low
temperatures and contribute greater resistance to changes in properties as a function of time or temperature than the asphaltic material 18. Preferably, the elongation of the modified asphaltic material 22 is at least two percent, even after extensive exterior exposure, such that as simulated by accelerated ageing carried out by storing shingles made with the modified asphaltic material at 158°F for at least 10 weeks.

[0033] Preferably, however, the modified asphaltic material is not so soft that its penetration at 77°F is greater than about 150 dmm, as measured according to ASTM D-5. Further, it is preferred that the lower surface of the modified asphaltic material be non-adhesive at ambient temperatures, reducing the likelihood that the improved shingles will become stuck together during shipment and prior to installation, or that the modified asphaltic material will become dislodged by handling during installation or subsequently thereto. Optionally, when a roofing product having self-adhesive properties in the modified asphalt material is desired, a removable or pealable release liner in film or sheet form may be applied to the lower surface of the shingle, so as to prevent sticking together of the shingles during shipment or prior to installation, and subsequently removed when applying the roofing product to a roof substrate.

[0034] It is preferred that enhanced temperature elongation be achieved by including in the modified asphaltic material a composition comprising one or more additives selected from elastomers, plasticizers, and resins, and blends thereof. Preferably, the elastomer is selected from natural rubber and thermoplastic elastomers, including styrene-isoprene-styrene block copolymers, styrene-butadiene-styrene block copolymer, and styrene-ethylene-butadiene-styrene block copolymer. The formulation can also include one or more antioxidants, and additional components such as oils.

[0035] The modified asphaltic material has greater elongation at low temperatures, such as about 32°F, than the asphaltic material 18 and retains an elongation at 32°F of at least two percent even after years of exterior exposure, such that the shingle 10 shows no cracking under impact.

[0036] The modified asphaltic material 22 may also have a lower modulus, especially at low temperatures, than the asphaltic material 18. That is, the modified asphaltic material is more extensible, as measured for example by the absence of cracking under stress or impact conditions in which the material 18 would crack. In particular, the modified asphaltic material 22 preferably has an elongation at break at low temperature, such as at 30°F, of at least two percent, even after accelerated ageing simulating years of exterior exposure, such as at least ten weeks of storage at 158°F. The modified asphaltic material will also be initially softer or have a lower initial modulus than the material 18, as measured for example by a higher penetration, particularly at higher temperatures. However, in non-self-adhesive applications, the modified asphaltic material 22 is preferably not so soft so as to be tacky or adhesive under ambient conditions, and preferably is not so soft as to “scuff” or suffer mechanical damage from handling during installation.

[0037] Under actual exterior exposure or simulated exterior exposure by accelerated ageing, it is often found that the modulus of asphaltic materials tends to increase such that the material becomes harder. The increase in modulus is often accompanied by a decrease in extensibility or elongation. As “toughness” conventionally refers to the area under a stress-strain curve, a material which requires increasing stress to attain a fixed strain as it ages can be said to be “tougher”. In the present invention, the modified asphaltic material 22 can become tougher as it ages, provided it retains the extensibility to provide an elongation at break of at least two percent.

[0038] Preferably, the enhanced extensibility is obtained by mixing an additive, a preblended admixture, or several additives with the same type of asphaltic material used for the asphaltic coating 18, and using this as the modified asphaltic material 22. For example, the material 18 can be a standard coating-grade asphalt (softening point 200°F-240°F), and the modified asphaltic material 22 can be prepared by mixing a jelly-like premixed asphalt modifier, such as those blends comprising plasticizers, oils, antioxidants and the like to promote polymer/asphalt compatibility and low temperature flexibility. Examples of such asphalt modifying compositions include but are not limited to those sold by the Chemseco Division of Sika Corporation (Kansas City, Mo.) under the Sikamod™ trademark. The modifying compositions are preferably blended with the steep or coating grade asphalt at a temperature between about 300°F and 400°F, with agitation sufficient to produce a homogeneous mixture. The choice of asphalt could also include an oxidized straight run type of asphalt that could be modified with a thermoplastic polymer.

[0039] Examples of polymeric materials which can be used include that which are known to improve the physical, low temperature, and durability performance characteristics of asphalt, such as atactic polypropylene (APP), isotactic polypropylene (IPP), styrene-butadiene rubber (SBS), chloroprene rubber (CR), natural and reclaimed rubbers, butadiene rubber (BR), acrylonitrile-butadiene rubber (NBR), isoprene rubber (IR), styrene-polysisoprene (SI), butyl rubber, ethylene propylene rubber (EPR), ethylene propylene diene monomer rubber (EPDM), polyisobutylene (PIB), chlorinated polyethylene (CPE), styrene ethylene-butylene-styrene (SEBS), and vinylacetate/polyethylene (EVA). Preferably a thermoplastic elastomer, such as a block copolymer of polystyrene, polybutadiene, and polystyrene blocks is employed.

[0040] Plasticizers may be selected from the group consisting of petroleum-derived oils, phthalate esters (or their derivatives) and melitates. Various petroleum resins, polyolefins, rosin (or its derivatives), tall oil, terpene and coumarone-indene resins can also be employed.

[0041] With reference now to FIG. 3, it will be seen that a base mat 37 is provided, impregnated with a first asphaltic material 38, having a layer of asphaltic material 40 thereon, which, like the embodiment of FIG. 2, may or may not be the same asphaltic material as that 38, and with a layer of granules 41 applied thereto, similar to that of the embodiment of FIG. 2. Another layer 42 of asphaltic material is applied beneath the impregnated mat 37, 38, which layer 42 may or may not be comprised of the same asphaltic material that comprises that 38 and 40. In the embodiment of FIG. 3, the lower layer of asphaltic material 44 is the layer of modified asphaltic material formulated as described above.
for layer 22, and having the same characteristics thereof, and which has a greater ability to resist cracking and a greater ability to dissipate energy that that of layers 38, 40. A layer 43 of fine granules, such as sand, talc, mica or the like, or alternatively, a release paper, other parting agent or layer of fabric, paper, plastic film or the like, is applied beneath the layer 44.

Thus, in the embodiment of FIG. 3, the shingle 110 has respective upper and lower surfaces 27 and 28, similar to the respective upper and lower surfaces 7 and 8 for the shingle of the embodiment of FIG. 2.

With reference to FIGS. 2A and 3A, it will be seen that the structures are the same as with FIGS. 2 and 3, respectively, except that the rear surfaces 8 and 28 are provided with a removable release liner 23a, 43a, respectively, in lieu of a fine layer of granules, and that the layers 22, 44, are self-adhesive, such that after the release liners 23a, 43a are removed, the shingles 10, 110, can be adhered to a substrate.

Referring now to FIG. 4, it will be seen that the rear surface of the shingle of either of FIGS. 2 and 3 appears the same, such that the illustration of FIG. 4 will be addressed only with respect to its relationship to the illustration of FIG. 3, it being understood that for purposes of the illustration of FIG. 4, the same description can be applied to a shingle as illustrated in FIG. 2.

The shingle 110, on its lower surface, is provided with a wind and/or crack-resistant reinforcement layer 50. The layer 50 may comprise a scrim, or thin fabric, or it may be comprised of a plastic film, paper, parchment or foil. In the case of a scrim, the scrim could be knitted, woven, non-woven, laminated scrim or the like. In the embodiment shown in FIG. 4, the reinforcement layer 50 is shown as comprising a woven construction, involving woven strands disposed at right angles to each other, with a preferred density of, for example, nine strands in the vertical direction and nine strands in the horizontal direction per square inch of reinforcement, covering the lower half of the rear surface of the shingle behind the tabs, although the layer 50 could, cover less of the rear surface of the shingle or the entire rear surface of the shingle, if desired. The layer 50 could be a woven or non-woven polyester, which would tend to make it a thinner layer. The layer 50 is preferably not applied deeply into the asphalitic material on the lower surface of the shingle 110, but rather is preferably slightly embedded into or placed on to the surface 28.

The reinforcement layer 50 of scrim or other material will ordinarily not be coated on its lower surface with a bitumen or other asphaltic material, nor will it have granules applied thereto, such that any filaments of the reinforcing material 50, especially those extending vertically as shown in FIG. 4, can resist bending and resist failure in the form of the likelihood of forming horizontal cracks across the upper end of the tab portion of the shingle when the shingle is bent upwardly within its elastic limit under forces applied by winds. However, if desired a thin layer of adhesive could be applied beneath the scrim or other reinforcement layer, with small particles of granular material, for example sand or the like, applied thereto. Additionally, the reinforcement material 50 may also serve to dissipate energy from impacts on the opposite, or upper surface, thus resisting crack formation on the rear surface. The vertical and horizontal strands of the reinforcement layer 50 can be of different materials, as may be desired, or may be disposed at other angles other than 90 degrees, such as diagonal, with or without vertical or horizontal strands. Optionally, the strands of the reinforcement layer could have random orientation, as, for example, from a non-woven web. Also, optionally, portions of the strands could be knitted.

The reinforcement material 50 may be comprised of various compositions other than fiberglass, such as polyester, and/or nylon, and the reinforcement 50 may either be slightly embedded in the asphaltic layer 44 on the rear of the shingle 110, or may be adhered to the rear of the shingle by an additional post-applied thin layer of asphaltic or non-asphaltic adhesive.

The asphaltic material that comprises the layers 22 and 44 may be constructed in accordance with the second asphaltic binder disclosed in U.S. Pat. No. 5,347,785, or as is the second asphaltic binder or modified asphalt as disclosed in U.S. Pat. No. 5,408,807, the complete disclosures of each of which are herein incorporated by reference, so long as they are in accordance with the above-mentioned characteristics.

Alternatively, the asphaltic material 22, 44, may be constructed of any other formulation that meets energy dissipation and crack resistant conditions desired when the front surface of the shingle is subjected to impact, so long as it is in accordance with the above-mentioned characteristics.

It will also be seen, with reference to FIG. 4, that a plurality of adhesive zones 49 can appear on the rear surface 28 of the shingle, toward the lower end of the tab zone of the shingle, beneath the layer of reinforcement material 50, such that the sealant that comprises the sealant patches 49 may bond to a next-subjacent shingle on a roof, by passing through openings in the mesh or web of the reinforcement material 50. The patches of sealant 49 are therefore an option for the embodiment of FIG. 4. Such patches 49, may, if desired, be arranged in a band, as shown, and may also, optionally be as set forth in U.S. Pat. No. 5,239,802, the complete disclosure of which is herein incorporated by reference.

With reference now to FIG. 5, it will be seen that a fragmentary illustration of a multi-tab shingle 210 is illustrated as comprising a shingle portion of the prior art type. The illustration of FIG. 5 demonstrates the result that can occur when impact against the upper surface of the shingle 210 occurs, such as being struck by a rock, tree limb, hail stone or the like, and wherein the rear or lower surface 211 of the shingle is subjected to cracking, in the form of what often occurs as partially circular cracks 212 along with partially radial cracks 213, which can result in shingle failure.

With reference to FIG. 5A, a fragmentary illustration of a shingle 310 in accordance with the present invention, wherein a modified asphaltic material 312 like that 22 of FIG. 2, having improved energy dissipation and crack resistance, is shown on the lower or rear surface of the shingle, and wherein the shingle of FIG. 5A has likewise been subjected to impact on its opposite surface, but wherein no crack formation is visible on the lower or rear surface 312 of the shingle of FIG. 5A.
With reference now to FIG. 6, the photographic illustration of a crack, similar to that of FIG. 5, is shown, where an impact has caused the crack 315 on the rear surface of the shingle.

In FIG. 6A, a photographic illustration appears, wherein a reinforcement layer, such as a scrim, is shown in the form of a rectangular grid on the rear surface, overlying the surface of modified asphalt layer, and wherein a circular zone 320 appears in the shingle, showing evidence of energy absorption after impact, but wherein no crack appears. The residual pattern after the impact shows movement, but not fracture within the modified asphalt layer of the shingle.

With reference to FIG. 7, there is illustrated a vertical sectional view, taken through a two layer laminated shingle, generally designated by the numeral 410. The shingle 410 is comprised of a full height shingle layer 411, constructed in section like the shingle of FIG. 2, which is adhered to a fractional layer, in this case, a substantially half-height shingle layer 412, with the layer 412 being substantially disposed against the posterior layer 413 of the shingle layer 411, below the headlap zone 414 thereof, to be disposed behind the tab zone 415 of the shingle layer 411. The half-height shingle layer 412 is likewise constructed like the shingle of FIG. 2, and the two shingle layers 411 and 412 are adhered together where their surfaces mate, by a suitable adhesive, at 416, disposed in layer form. One or more portions of the half-height shingle layer 412 may optionally extend below the lower edge 417 of the tab zone 415 of the shingle layer 411. Optionally, the shingle layer 412 could be a full back layer as shown in phantom in FIG. 7, such that the entire shingle layer 412 is impact resistant.

Referring now to FIG. 8, it will be seen that a shingle layer 510, having granules 511 on its upper surface, already impregnated with an asphaltic material, is delivered along a horizontal path, in the direction of the arrow 512, over suitable conveyor rollers 513 or the like, to pass over an applicator such as that 514 of the roller-in-tank type 515, wherein the modified asphaltic material 516, like that of 22 in FIG. 2, disposed in the tank 515 is applied to the under surface 517 of the shingle material 510, as it passes over the roller 514, rotating in the direction of the arrow 518. In this manner, a thin layer of molten asphaltic material of the modified type can be applied, generally at a factory installation, in liquid applicator form. Alternatively, an applicator capable of a spray coating or other coating application method (not shown) could be used to apply the modified asphaltic material 516 to the under surface 517 of the shingle material 510. Following the application of the modified asphaltic material 516, the bottom side of the applied modified asphaltic layer like that of 22 of FIG. 2 could be covered by sand, talc, mica or other fine mineral material, or by a layer fabric, polymeric film, scrim, paper or the like as 23 of FIG. 2.

With reference to FIG. 9, it will be seen that a layer of shingle 610 having granules 611 on an upper surface thereof, is already fully formed, except that a layer of modified asphaltic material 612, like that of 22 of FIG. 2, may be post-manufacture adhered, applied as an already-formed layer, by moving the same in the direction of the arrows 613, and applying heat, or adhesive means, to adhere the layer 612 of modified asphaltic material, to the lower surface 614 of the shingle 610. Thus, in the embodiment of FIG. 9, the layer 612 of modified asphaltic material may be provided either at the site of manufacture, or at the site of installation, as may be desired.

In either of the embodiments of FIGS. 8 and 9, the layer of material 516 or 612 could alternatively be an impact energy dissipation layer having a lower elastic modulus (i.e., being softer) and having the desired elongation capability such as being comprised of a thin layer of membrane, self-adhesive or non-self-adhesive (in the latter case secured thereto by another adhesive), including but not limited to a polymer-modified asphaltic material layer or an elastomeric membrane like ethylene-propylene-diene monomer (EPDM). In the embodiment of FIG. 9, the energy dissipation layer could be applied to the lower surface of the shingle or to a roofing membrane. Alternatively, the energy dissipation layer could be applied to a roof substrate and the lower surface of a shingle could subsequently be applied thereto.

In accordance with this invention, it will also be seen that there is provided a method of making an impact resistant roof covering system. In accordance with such a method, a shingle is provided having a first asphaltic material that has an elasticity as determined by a first level of softness and a first level of elongation at break. A layer of a second asphaltic material that has a second softness that is softer than the softness of the first asphaltic material, and which has a second elongation at break that is greater than the elongation at break of the first asphaltic material. The second asphaltic material is applied to a roof substrate, and thereafter the shingle is applied to the roof substrate. Alternatively, the second asphaltic material can be applied to the lower surface of the shingle prior to applying the shingle to the roof substrate.

It will be apparent from the foregoing that various modifications may be made in the details of construction, as well as in the use and operation of the present invention, all within the spirit and scope of the invention, as claimed.

What is claimed is:

1. An impact resistant shingle having upper and lower surfaces, comprising:

   (a) a base mat having upper and lower surfaces and impregnated with a first asphaltic material;

   (b) the first asphaltic material having an elasticity as determined by a first softness and a first elongation at break;

   (c) a second asphaltic material being on the upper surface of the base mat;

   (d) a layer of mineral granules being disposed on and adhered to the second asphaltic material on the upper surface of the base mat, and comprising at least a portion of the upper surface of the shingle;

   (e) a third asphaltic material being disposed beneath the lower surface of the base mat;

   (f) the third asphaltic material being of a second softness that is a softer material than the softness of the first asphaltic material, and of a second elongation at break that is greater than the elongation at break of the first asphaltic material, whereby;
(g) energy from impacts on the upper surface of the shingle is at least partially dissipated at the lower surface of the shingle by the softness and elongation of the third asphaltic material, such that crack formation on the lower surface of the shingle due to impacts on the upper surface of the shingle, is avoided.

2. The shingle of claim 1, wherein the first and second asphaltic materials are of the same formulation.

3. The shingle of claim 1, wherein the first and second asphaltic materials are of different formulations.

4. The shingle of claim 1, wherein the third asphaltic material is disposed against the lower surface of the base mat.

5. The shingle of claim 1, wherein first asphaltic material is disposed against the lower surface of the base mat, and the third asphaltic material is disposed below and adhered to the first asphaltic material.

6. The shingle of any one of claims 4 and 5, wherein the third asphaltic material is a liquid-applied coating during the manufacture of the shingle.

7. The shingle of any one of claims 4 and 5, wherein the third asphaltic material comprises a sheet of asphaltic material, applied to the shingle in sheet form.

8. The shingle of any one of claims 1, 4 and 5, wherein the shingle comprises a first thickness layer between upper and lower surfaces thereof, wherein a wind-resistant layer of a second thickness of substantially thinner dimension than that of said first thickness layer, is provided on the lower surface of the first thickness layer, over at least a portion of the lower surface of the first thickness layer, adhered thereto.

9. The shingle of claim 8, wherein the second thickness layer is adhered to the first thickness layer by an asphaltic material.

10. The shingle of claim 8, wherein the second thickness layer is adhered to the first thickness layer by the third asphaltic material.

11. The shingle of claim 8, wherein a granular material is disposed between said first thickness layer and the second thickness layer.

12. The shingle of claim 11, wherein the second thickness layer is adhered to the first thickness layer by an asphaltic material.

13. The shingle of claim 11, wherein the second thickness layer is adhered to the first thickness layer by the third asphaltic material.

14. The shingle of any one of claims 1, 4 and 5, wherein the third asphaltic material comprises a polymer-modified asphaltic material.

15. The shingle of claim 8, wherein the second thickness layer comprises a material selected from the group consisting of any one of:

(a) thin fabric;
(b) plastic film;
(c) paper;
(d) pavement; and
(e) foil;
(f) metal screen;
(g) plastic netting;
(h) glass fibers pressed into the second asphaltic material;
(i) plastic fibers pressed into the second asphaltic material;
(j) spin blown fibers pressed into the second asphaltic material;
(k) scrim.

16. The shingle of any one of claims 2 and 3, wherein the shingle comprises a first thickness layer between upper and lower surfaces thereof, wherein a wind-resistant layer of a second thickness of substantially thinner dimension than that of said first thickness layer, is provided on the lower surface of the first thickness layer, over at least a portion of the lower surface of the first thickness layer, adhered thereto, with the shingle having a butt portion adapted to being substantially covered by another shingle when applied to a roof and a tab portion adapted to being exposed to weather when applied to a roof, wherein the second thickness layer comprises cross-strings or reinforcing material disposed behind the tab portion of the shingle and substantially completely covering the surface behind said tab portion of the shingle.

17. A shingle according to claim 1, wherein the third asphaltic material has an elongation at break of at least two percent.

18. A shingle according to claim 17, wherein the third asphaltic material has an elongation at break of at least two percent measured at about 50° F after aging the shingle for at least ten weeks at 158° F.

19. A shingle according to claim 17, wherein the third asphaltic material has a penetration of less than about 150 decimeters at 77° F.

20. A shingle according to claim 1, wherein the third asphaltic material is non-adhesive at ambient temperature.

21. A shingle according to claim 1, wherein the third asphaltic material includes a softening composition comprising elastomer and plasticizer.

22. An impact resistant roofing element having upper and lower surfaces, comprising:

(a) a base mat having upper and lower surfaces and impregnated with a first asphaltic material;
(b) the first asphaltic material having an elasticity as determined by a first softness and a first elongation at break;
(c) a second asphaltic material being on the upper surface of the base mat;
(d) a layer of mineral granules being disposed on and adhered to the second asphaltic material on the upper surface of the base mat, and comprising at least a portion of the upper surface of the roofing element;
(e) a third asphaltic material being disposed beneath the lower surface of the base mat;
(f) the third asphaltic material being of a second softness that is a softer material than the softness of the first asphaltic material, and of a second elongation at break that is greater than the elongation at break of the first asphaltic material, whereby;
(g) energy from impacts on the upper surface of the roofing element is at least partially dissipated at the lower surface of the roofing element by the softness and elongation of the third asphaltic material, such that crack formation on the lower surface of the roofing
element due to impacts on the upper surface of the roofing element, is avoided.

23. A shingle according to claim 1, wherein the third asphaltic material has self-adhesive properties, the self-adhesive properties allowing the product to be adhered to a roofing substrate.

24. A shingle according to claim 21, wherein a lower surface of the third asphaltic material is protected by a release agent surfaced layer, the release agent surfaced layer being removable from the lower surface of the third asphaltic material to expose the self-adhesive third asphaltic material at the lower surface of the shingle.

25. A method of making an impact resistant roof covering system, comprising the steps of:

(a) providing a shingle comprising a first asphaltic material having an elasticity as determined by a first softness and a first elongation at break;

(b) providing a layer of a second asphaltic material of a second softness that is softer than the softness of the first asphaltic material, and of a second elongation at break that is greater than the elongation at break of the first asphaltic material;

(c) applying the layer of the second asphaltic material to a roof substrate; and,

(d) applying the shingle to the roof substrate.

26. The method according to claim 23, wherein the layer of the second asphaltic material is applied to the roof substrate prior to applying the shingle.

27. The method according to claim 23, wherein the layer of the second asphaltic material is applied to a lower surface of the shingle prior to applying the shingle to the roof substrate.

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