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(54) HEATABLE STRATIFIED MATERIAL AND MANUFACTURING METHOD THEREFOR

(71) I, WILLIAM CHARLES HELLER, JR., of 1840 North Farwell Avenue, Milwaukee, Wisconsin 53202, United States of America, a citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Background of the Invention—Field of the Invention

The present invention relates to stratified or layered plastics materials, to methods of forming same, and to articles incorporating such materials.

Background of the Invention—Description of the Prior Art

Recent developments have shown the superiority of incorporating heat generating agents directly in article parts to be joined together, thus enabling such joining to be achieved by thermal fusion bonding. This may typically be accomplished by dispersing in the plastics materials a particulate material which is susceptible to heating by energy applied indirectly from a remote source. The indirectly applied energy may be in the form of an alternating magnetic field, in which case heat generation is by eddy current losses or hysteresis losses. The indirectly applied energy may be in the form of an alternating electric field, in which case the heat generation is by dielectric losses.

The advantages of the aforesaid technique include, among others, concentration of the heat at or near the bonding interface, close control of bonding temperature, and ease of handling since no adhesive or other bonding accessories are required.

However, many of the susceptible parti-

culate materials, hereinafter termed susceptors, possess undesirable colorations. For example, a highly useful class of heat generating materials includes metal oxide particles having ferromagnetic properties which render them susceptible to heating by an alternating magnetic field. However, these particles exhibit distinct color properties. For example, the iron oxides Fe_2O_3 and Fe_3O_4 , both of which are very efficiently heated by alternating magnetic fields, are brown and black respectively, in color. As most common plastics are at least to some degree transparent, the dispersion of the iron oxide particles turns the plastics material brown or black.

Thus, it is often desirable to mask the coloration caused by incorporation of the susceptor with an opaque layer, for example, a white layer, to hide the particle coloration. The result is a multi-layer structure having a heat generating layer and an opaque masking layer. In a more general aspect, it may be desirable to provide a heatable stratified plastics structure which advantageously combines the desirable properties of several different types of plastics.

The present invention utilizes the technique of coextrusion to provide the aforesaid stratified material. In coextrusion, two or more plastics materials are placed in a fusible state and are extruded. Before, during, or after the plastics materials emerge from the dies, they are intimately bonded together to form a stratified material.

In the present invention, a finely divided susceptor is incorporated in one of the co-extruded plastics materials, thereby to provide a stratified material, in which a single layer includes the finely divided susceptor which is heatable by energy indirectly applied from a remote source which strati-

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fied material may be thicker than that which can be provided by coating or other methods. Further, the strength of the bond between coextruded strata will normally exceed by far that obtainable by adhesive coating techniques.

5 More particularly, this invention provides a method of forming a stratified material, a single layer of which contains a finely divided susceptor in which heat can be induced by exposure to a high frequency alternating magnetic or alternating electric field, said method comprising the steps of:

10 providing a plurality of fusible thermoplastic compositions at respective first locations removed from a layer forming die;

moving the compositions from the first locations toward the die, the movement of one or more of the compositions being accompanied by an agitation thereof;

20 incorporating in the one composition, during its movement toward the die and by means of its agitation, the finely divided susceptor;

25 heating the compositions during the movement, to a malleable state and a state wherein the compositions are fusible with one another; and

30 concurrently forcing the heated compositions through the die into intimate contact with each other while in said malleable and fusible state to join the layers of the compositions so as to form the stratified material.

35 The invention further extends to a method, as aforesaid, for forming an article having a plurality of parts and including the further steps of:

40 forming the coextruded material into a first article part;

providing a second article part having a region which is thermally joinable to a layer of a fusible thermoplastics material;

45 juxtapositioning the first and second article parts so that the thermally joinable region of the second article part and said first article part are contiguous;

50 exposing the region of the first article part contiguous with the thermally joinable region of the second article part to a high frequency alternating magnetic or alternating electric field to heat the first article part; and

55 bringing the contiguous portions of the first and second article parts into contact to effect joinder between the two to form the article.

60 From a further aspect, this invention provides a stratified material formed by the method as hereinbefore defined comprised of at least a pair of coextruded thermoplastics layers intimately joined together, a single one of said layers having incorporated therein a finely divided susceptor in which heat can be induced by exposure to a high fre-

quency alternating magnetic or alternating electric field. 65

The invention may be performed in various ways and preferred embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:— 70

Figure 1 is a partially diagrammatic illustration of the practice of the method of the present invention. Figure 1 further shows a novel article formed by the method of the present invention. 75

Figure 2 is a detailed, partial, cross sectional view of one embodiment of the stratified material of the present invention.

Figure 3 is a detailed, partial, cross sectional view of another embodiment of the stratified material of the present invention. 80

Figure 4 is a partially diagrammatic illustration of the practice of another embodiment of the method of the present invention. Figure 4 shows another novel article formed by the method of the present invention. 85

Figure 5 is a partially diagrammatic illustration of the practice of another embodiment of the method of the present invention. Figure 5 also shows a novel article formed by the method of the present invention. 90

Figure 6 is a partially diagrammatic illustration of the practice of another embodiment of the method of the present invention. Figure 6 further shows a novel article portion formed by the method of the present invention. 95

Figure 7 is a detailed, partial, cross sectional view of the article portion shown in Figure 6. 100

Figures 8 and 9 are detailed, partial, cross sectional views showing modifications of the stratified material shown in Figure 7.

Figure 10 is a partial, cross sectional view showing an article formed of the stratified material shown in Figure 9. 105

Description of the Preferred Embodiments

Figure 1 shows the process steps in forming, by coextrusion techniques, a stratified material including a layer which is heatable by energy indirectly applied from a remote source. Initially, the plastics materials for the layers of the stratified structure are selected. These materials may be of the same type, for example, all polyethylene, all polypropylene, or all polystyrene, or may be different types so as to provide a composite structure incorporating the desirable properties of a plurality of plastics materials. The integrity of a coextrudable structure depends on the fusion-like bond obtained between the layers, so that the plastics materials forming the stratified structure need to be thermally fusible with one another. 115 120 125

In Figure 1, a two layer stratified material is formed, and hence two plastics compositions are employed. For purposes of

explanation, it may be assumed that the co-extruded stratified material consists of a 10 mil interconnecting (or joinder) layer of polyethylene containing the susceptor and a 40 mil layer, also of polyethylene, which provides structural strength to the material. The 40 mil layer may also be pigmented to mask the coloration of the 10 mil layer by the dispersion of a filler, such as titanium dioxide, in the layer. The stratified material 8 so formed is shown in Figure 2 to include masking layer 2 and heatable layer 4 containing susceptor 6.

Another two layer structure might typically consist of a 50 mil layer of an acrylonitrile copolymer having a 10 mil layer of the acrylonitrile copolymer containing the susceptor.

Susceptor 6 comprises a particulate substance heatable by a selected form of indirectly applied energy. The susceptor may be in the form of granules of solid material or droplets of liquid material incorporated in the plastics material of the carrier layer. In the instance in which the indirect energy is applied in the form of an alternating magnetic field, the susceptor may comprise an inductively heatable substance. Susceptors comprising, at least in part, metallic oxides having ferromagnetic properties are suitable for use as an inductively heatable susceptor 6. Susceptor 6 may comprise ferrite materials. The oxide compounds, gamma Fe_2O_3 , Fe_3O_4 , and CrO_2 have been found to be useful susceptors. In addition to their high heat generating properties by hysteresis losses such compounds may be reduced to extremely small size. This size reduction is without loss of heat generating properties and facilitates the dispersion of susceptor 6 in layer 4. Metallic oxide susceptors may be reduced to submicron particle sizes, for example, .01 microns. A typical maximum particle size is 20 microns. The amount of such particles utilized depends on the heating rates desired in heatable layer 4. The amount of particulate susceptor may range from less than 1% to 30% or more by weight with respect to the plastic of layer 4. Since a fewer number of large particles will provide the same particle loading as a large number of small particles, under certain circumstances, large particles may be employed to reduce coloration of the plastics material. Such large particles may have sizes ranging up to 250 microns.

In the instance in which the indirect energy is applied in the form of an alternating electric field, the susceptor may comprise a polar material heatable by dielectric losses. The polymers and copolymers of vinyl chloride, vinyl fluoride, vinylidene chloride and vinylidene fluoride are suitable for use as dielectrically heatable susceptors.

A polyvinyl chloride susceptor has been found useful.

For purposes of the present exemplary tor 6 is an iron oxide, inductively heatable description, it may be assumed that susceptor by an alternating magnetic field.

Plastics 2 and 4 will usually be of extrusion grade and are commonly provided in pellet or flake form. Plastics material 2 is placed in hopper 10 while plastics material 4 is placed in hopper 12. Hoppers 10 and 12 supply the plastics to coextrusion machine 14.

Coextrusion machine 14 may comprise a pair of extrusion passages 16 and 18, each of which comprise a tubular passage down which a plastics material may be propelled toward an extrusion die. For example, extrusion passage 16 includes tube 20. Auger 22 rotated by motor 24 is positioned in tube 20 to receive plastics material 2 from hopper 10, via loading apparatus 26, and move the material toward extrusion die 28. In the method of Figure 1, a coextruded flat sheet is formed. For this purpose, extrusion die 28 may comprise the end of tube 20 formed as an elongated slot. Or, a separate extrusion die may be affixed to the end of tube 20. The plastics material may be heated to the fusible state during its passage down tube 20, as by heater 30. The speed of motor 24 is regulated by control 32.

Extrusion passage 18 is similar in construction to extrusion passage 16. Plastics material 4 in hopper 12 is supplied to extrusion passage 18 by loading apparatus 34. Since plastics material 4 which is formed in passage 18 carries particulate susceptor 6, it is necessary to provide some technique for admixing the two substances.

Accordingly, the desired mixing is produced by action in extrusion passage 18. For this purpose, hopper 36 is provided for the particulate susceptor material. The particulate susceptor 6 feeds into loading apparatus 38.

In the process of the present invention, plastics material 4 passes from hopper 12 into loading apparatus 34. The particulate susceptor 6 passes from hopper 36 into loading apparatus 38. A valve 40, or other control means may be provided to regulate the amount of susceptor material provided. As auger screw 22 in extrusion passage 18 moves plastics material 4 and the susceptor material down extrusion passage 18, plastics material 4 and susceptor 6 become mixed. The heating of plastics material 4 to the fusible state by heater 30, combined with the agitation provided by auger 22 causes susceptor 6 to be incorporated in plastics material 4 as the plastics material approaches extrusion die 42 at the end of extrusion passage 18. Extrusion die 42, either as the end of extrusion passage 18 or

as a separate element, may be formed as an elongated slot.

Plastics material 2 feeds from hopper 10 into loading apparatus 26. Auger screw 22 moves plastics material 2 down extrusion passage 16, where it is placed in the fusible state by heater 30. The filler material necessary to render plastics material 2 opaque may be incorporated in the plastics material prior to extrusion or it may be dispersed in plastics material 2 in extrusion passage 16 in a manner similar to that described above in connection with susceptor 6.

Extrusion die 28 and extrusion die 42 which in combination form a layer forming die are positioned so that before, during, or after the layers of plastics material 2 and plastics material 4 emerge from the extrusion dies, they are placed in contact and fused together. The coextrusion process provides sufficient mixing of plastics material 2 and plastics material 4 to provide a high strength bond without excessive dispersion of one plastics material within the other. Pressure rolls 44 and 46 may assist in the formation of the joinder layer. The process is completed by cooling the coextruded materials to the solid state.

The result is a stratified material 8 having the plastics materials 2 layer on top and the plastics material 4 layer containing particulate susceptor 6 on the bottom, as shown in Fig. 2. The thickness of the plastics material layers may be controlled by the size of dies 28 and 42, the speed at which augers 22 are rotated by motors 24, the screw configuration of augers 22, the diameters of extrusion passages 16 and 18, the temperatures of plastics materials 2 and 4, etc.

Figure 1 also shows a method for forming a container article incorporating the stratified material 8 produced by the above described method. In the disclosed exemplary embodiment, the stratified material 8 forms the lid of a container article. To this end, the stratified material 8 is placed under punching machine 50 which punches a disc-like container lid blank 52 therefrom. Blank 52 is heated in thermoforming machine 54 to provide lid 56 having an upturned sealing lip 58. Plastic material 4 containing susceptor 6 forms the outer surface of sealing lip 58.

The bottom of the container article is formed from a sheet of plastics material 60. Plastics material 60 is selected to be thermally joinable to the plastics material 4. A container bottom blank 62 is provided from sheet 60 by punching machine 64. Blank 62 is passed through thermoforming machine 66 to form container bottom 68 having flange 70 designed to mate with lip 58 of lid 56.

After filling container bottom 68, lid 56 is placed on container bottom 68 with lip 58

in abutment with flange 70. An induction heating coil 72 is placed adjacent lip 58 and flange 70.

Upon the energization of induction heating coil 72 by high frequency source 74, susceptor 6 becomes heated by the alternating magnetic field, heating plastics material 4 and the abutting portions of flange 70. The frequency of the alternating magnetic field may be selected in accordance with desired heating rates, type of susceptor, etc. The frequency may typically be from 450 kilohertz to 5000 megahertz. For a coil type generator the maximum frequency is typically 35-50 megahertz. After heating plastics material 4 and flange 70 to the thermal joining temperature, coil 72 may be deenergized and pressure applied to the top of lid 56 and the base of bottom 68, to complete the joining of lid 56 and container bottom 68. The time required for heat sealing will depend on susceptor type and loading, field frequency, etc., but is typically less than 1 second.

While stratified material 8 is shown as a two element structure in Fig. 2, additional layers may be incorporated in the material, as shown in Figure 3. In that Figure a three element material 80 is shown having a 3 mil heat sealable layer 82 of high density polyethylene, a 5 mil heat generating and barrier polyvinylidene chloride layer 84 containing susceptor 6, and a 20 mil high density polyethylene layer 86 which provides structural strength to the material.

Figure 4 shows a method of forming a plastics container, similar in form and shape to an ordinary tin can. The stratified material is formed, as by thermo-forming material 90, into a circular container lid 92 having an annular flange 94 and an opening tag 98. Plastics material 4 containing susceptor 6 is located on the outside of flange 94. A bottom 96 for the container is also formed in a similar manner. The body for the container may be formed from tubular stock which is cut to form body 99 having the desired length.

Bottom 96 is inserted in one end of tubular body 99, as shown in Figure 4, so that plastics material 4 on flange 94 is contiguous with the inside of body 99. Induction heating coil 72 is placed adjacent the end of body 99 and energized. The resulting magnetic field heats susceptor material 6, flange 94, and container body 99 forming a thermal joint between bottom 96 and container body 99.

The container may then be filled and closed by lid 92. Lid 92 is bonded to body 99 by a process similar to that used to bond bottom 96 to body 99.

While the method and article of Figures 1 and 3 show the use of a stratified structure in forming the closure element of a con-

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tainer, stratified structures may also be utilized in the body of the container. In Figure 5, coextrusion machine 14a provides a tubular product rather than a sheet product, as shown in connection with coextrusion machine 14 of Figure 1. Coextrusion machine 14a utilizes two extrusion passages 16a and 18a fed by loading apparatus 26 and 34, respectively. The extrusion passages and the extrusion dies are concentrically arranged and combine to form a layer forming die so that a cylinder of plastics material 2 is formed having a layer of plastics material 4 and susceptor 6 intimately joined to the inside of the cylinder.

The coextruded tubular stock so formed is cut to length by shear 100 to form tubular container bodies 102. The lid and bottom 104 for container body 102 are punched from a plastics sheet and thermo-formed to include flange 106. Lid and bottom 104 are inserted in body 102 and joined by induction heating coil 72 in the manner described above. Susceptor 6 in container body 102 may additionally serve as a light barrier to protect the contents from deterioration by exposure to light.

While susceptor materials, such as iron oxide, are quite low in cost, thereby permitting their use throughout articles formed from the stratified structure, it may, in some cases, be desirable to provide the susceptor only at the locations at which heating is desired. Figure 6 shows an example of this technique in which the susceptor material is provided only at the locations at which heat sealing is desired.

The tubular stock 108 for container bodies 110, similar to container bodies 102 shown in Figure 5, is formed. However, instead of continuously coextruding the coaxial cylinders of plastics materials 2 and 4, plastics material 4 is only intermittently coextruded on the inside of the plastics material 2 cylinder. Specifically, a band of plastics material 4 is provided at either end of the tubular container bodies 110, as shown in greater detail in Figure 7. To this end, the operation of shear 100 and the passage of plastics material 4 through extrusion passage 18a is coordinated to provide axially spaced annular areas 112 of plastics material 4 on the cylinder on the plastics material 2 and to cut the tubular stock 108 in the center of the annular areas 112 to form annular bands 114 at either end of container body 108.

A measuring device 116, including measuring wheel 118, rotatable by the extruded cylinder of plastics material 2 may be used to record the length of the tubular stock issuing from coextrusion machine 14a. Measuring device 116 is coupled to shear 100 to actuate the shear when a quantity of tubular stock commensurate with the desired size of container body 110 has passed.

Measuring device 116 is also coupled to control 32a which regulates the movement of plastics material 4 in extrusion passage 18a by means of motor 24a.

In operation, measuring device 110 measures the length of the plastics material 2 cylinder issuing from coextrusion machine 14a. After a predetermined length of tubular stock 108 has passed measuring device 116, the device causes control 32a to move plastics material 4 down extrusion passage 18a to coextrude plastics material 4 and susceptor 6 on the interior of plastics material 2 for a preset length of the plastics material 2 cylinder, after which the coextrusion stops. This forms the annular area 112 of plastics material 4 on the inside of plastics material 2 cylinder. The extrusion of plastics material 2 alone continues.

As the passage of the tubular stock extrudes, measuring device 116 actuates shear 100 to sever tubular stock 108 in the middle of annular area 112. The above process is then repeated and the resulting product is shown in Figure 6 comprising a cylinder having a band 114 of plastics material 4 and susceptor 6 coextruded at either end thereof. The ends of the cylinder 110 may be affixed to container ends in the manner described in connection with Figure 6 to provide the completed container.

If it is desired to avoid the unevenness in the thickness of the stratified material shown in Figure 7 caused by the spaced coextrusion of plastics materials 2 and 4, plastics material 4 may be continuously coextruded with plastics material 2 but susceptor 6 only intermediately incorporated in plastics material 4. A stratified material so formed is shown in Figure 8 and may be provided by connecting measuring device 116 to valve 40 in loading apparatus 38 for susceptor 6 so that the susceptor is periodically incorporated in plastics material 4 in extrusion passage 18a.

In the alternative, the thickness of each of the coextruded layers may be controlled to maintain the thickness of the stratified material constant. Thus as the layer of plastics material 4 is periodically coextruded with plastics material 2, the thickness of the latter may be reduced, as shown in Figure 9 to maintain the thickness of the stratified material constant. This technique can be obtained by coupling measuring device 116 to the control for each of the coextrusion passages 16a and 18a to coordinately reduce the thickness of the layer of plastics material 2 when plastics materials 2 and 4 are being coextruded.

The use of the stratified material shown in Figure 9 in a container permits the lid to overlap the container body, as shown in Figure 10 since the coextruded plastic material 4 containing susceptor 6 may lie

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inside the cap, to hide the colouration of the susceptor 6.

WHAT I CLAIM IS:—

1. A method of forming a stratified material, a single layer of which contains a finely divided susceptor in which heat can be induced by exposure to a high frequency alternating magnetic or alternating electric field, said method comprising the steps of:
 - providing a plurality of fusible thermoplastic compositions at respective first locations removed from a layer forming die;
 - moving the compositions from the first locations toward the die, the movement of one or more of the compositions being accompanied by an agitation thereof;
 - incorporating in the one composition, during its movement toward the die and by means of its agitation, the finely divided susceptor;
 - heating the compositions, during the movement, to a malleable state and a state wherein the compositions are fusible with one another; and
 - concurrently forcing the heated compositions through the die into intimate contact with each other while in said malleable and fusible state to join the layers of the compositions so as to form the stratified material.
2. The method according to Claim 1 wherein at least one of the layers has an external surface and incorporates a region formulated to possess the property of thermal joinability to another body of fusible thermoplastics composition upon the generation of heat in the finely divided susceptor.
3. The method according to Claim 2 for forming an article having a plurality of parts and including the further steps of:
 - forming the coextruded material into a first article part;
 - providing the said another body in the form of a second article part having a region which is thermally joinable to a layer of the stratified thermoplastics material;
 - juxtapositioning the first and second article parts so that the thermally joinable region of the second article part and said first article part are contiguous;
 - exposing the region of the first article part contiguous with the thermally joinable region of the second article part to a high frequency alternating magnetic or alternating electric field to heat the first article part; and
 - bringing the contiguous portions of the first and second article parts into contact to effect joinder between the two to form the article.
4. The method according to any one of Claims 1 to 3 wherein the steps of the method are carried out continuously.
5. The method according to any of

Claims 1 to 4 wherein at least one layer of the stratified material is continuously formed while a second layer thereof is formed intermittently.

6. The method according to Claim 5 wherein the second layer incorporates the susceptor.

7. The method according to any one of Claims 1 to 6 wherein another of the thermoplastic compositions is rendered at least partially opaque, thereby to mask the one composition layer containing the finely divided susceptor in the finished stratified material.

8. The method according to any one of Claims 1 to 7 wherein the susceptor has ferromagnetic properties.

9. The method according to Claim 8 wherein the susceptor comprises metallic oxides having ferromagnetic properties.

10. The method according to Claim 8 wherein the susceptor comprises an oxide of iron or chromium having ferromagnetic properties.

11. The method according to any one of Claims 1 to 7 wherein the susceptor is selected from a material class consisting of the polymers and copolymers of vinylidene fluoride.

12. The method according to any one of Claims 1 to 11 wherein the susceptor comprises particles having sizes ranging up to 20 microns.

13. The method according to any one of Claims 1 to 12 wherein the susceptor is present in quantities up to 30% by weight with respect to the one composition.

14. The method according to any one of Claims 1 to 13 wherein heating of the material is achieved by exposing the material to a high frequency magnetic field having a frequency of between 4 and 5000 megahertz.

15. A stratified material formed by the method claimed in Claim 1 and comprised of at least a pair of coextruded thermoplastics layers intimately joined together, a single one of said layers having incorporated therein a finely divided susceptor in which heat can be induced by exposure to a high frequency alternating magnetic or alternating electric field.

16. The stratified material according to Claim 15 wherein an external surface of one of the layers of the stratified material possesses the properties of thermal joinability to another layer of thermoplastics material.

17. The stratified material according to Claim 15 or Claim 16 wherein the other of said plastics layers of said stratified material is at least partially opaque thereby to mask the layer containing the finely divided susceptor in the finished stratified material.

18. The stratified material according to any one of Claims 15 to 17 wherein the



inside the cap, to hide the colouration of the susceptor 6.

WHAT I CLAIM IS:—

- 5 1. A method of forming a stratified material, a single layer of which contains a finely divided susceptor in which heat can be induced by exposure to a high frequency alternating magnetic or alternating electric field, said method comprising the steps of:
 - 10 providing a plurality of fusible thermoplastic compositions at respective first locations removed from a layer forming die;
 - moving the compositions from the first locations toward the die, the movement of one or more of the compositions being accompanied by an agitation thereof;
 - incorporating in the one composition, during its movement toward the die and by means of its agitation, the finely divided susceptor;
 - heating the compositions, during the movement, to a malleable state and a state wherein the compositions are fusible with one another; and
 - concurrently forcing the heated compositions through the die into intimate contact with each other while in said malleable and fusible state to join the layers of the compositions so as to form the stratified material.
- 30 2. The method according to Claim 1 wherein at least one of the layers has an external surface and incorporates a region formulated to possess the property of thermal joinability to another body of fusible thermoplastics composition upon the generation of heat in the finely divided susceptor.
- 40 3. The method according to Claim 2 for forming an article having a plurality of parts and including the further steps of:
 - forming the coextruded material into a first article part;
 - providing the said another body in the form of a second article part having a region which is thermally joinable to a layer of the stratified thermoplastics material;
 - juxtapositioning the first and second article parts so that the thermally joinable region of the second article part and said first article part are contiguous;
 - exposing the region of the first article part contiguous with the thermally joinable region of the second article part to a high frequency alternating magnetic or alternating electric field to heat the first article part; and
 - bringing the contiguous portions of the first and second article parts into contact to effect joinder between the two to form the article.
- 60 4. The method according to any one of Claims 1 to 3 wherein the steps of the method are carried out continuously.
- 65 5. The method according to any of

Claims 1 to 4 wherein at least one layer of the stratified material is continuously formed while a second layer thereof is formed intermittently.

- 70 6. The method according to Claim 5 wherein the second layer incorporates the susceptor.
- 75 7. The method according to any one of Claims 1 to 6 wherein another of the thermoplastic compositions is rendered at least partially opaque, thereby to mask the one composition layer containing the finely divided susceptor in the finished stratified material.
- 80 8. The method according to any one of Claims 1 to 7 wherein the susceptor has ferromagnetic properties.
- 85 9. The method according to Claim 8 wherein the susceptor comprises metallic oxides having ferromagnetic properties.
- 10 10. The method according to Claim 8 wherein the susceptor comprises an oxide of iron or chromium having ferromagnetic properties.
- 90 11. The method according to any one of Claims 1 to 7 wherein the susceptor is selected from a material class consisting of the polymers and copolymers of vinylidene fluoride.
- 95 12. The method according to any one of Claims 1 to 11 wherein the susceptor comprises particles having sizes ranging up to 20 microns.
- 100 13. The method according to any one of Claims 1 to 12 wherein the susceptor is present in quantities up to 30% by weight with respect to the one composition.
- 105 14. The method according to any one of Claims 1 to 13 wherein heating of the material is achieved by exposing the material to a high frequency magnetic field having a frequency of between 4 and 5000 megahertz.
- 110 15. A stratified material formed by the method claimed in Claim 1 and comprised of at least a pair of coextruded thermoplastics layers intimately joined together, a single one of said layers having incorporated therein a finely divided susceptor in which heat can be induced by exposure to a high frequency alternating magnetic or alternating electric field.
- 115 16. The stratified material according to Claim 15 wherein an external surface of one of the layers of the stratified material possesses the properties of thermal joinability to another layer of thermoplastics material.
- 120 17. The stratified material according to Claim 15 or Claim 16 wherein the other of said plastics layers of said stratified material is at least partially opaque thereby to mask the layer containing the finely divided susceptor in the finished stratified material.
- 125 18. The stratified material according to any one of Claims 15 to 17 wherein the
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- susceptor comprises an oxide of iron or chromium having ferromagnetic properties.
19. The stratified material according to any one of Claims 15 to 17 wherein the
- 5 susceptor is selected from a material class consisting of the polymers and copolymers of vinylchloride, vinyl fluoride, vinylidene chloride and vinylidene fluoride.
20. The stratified material according to
- 10 any one of Claims 15 to 19 wherein the finely divided susceptor has particle sizes ranging up to 20 microns.
21. The stratified material according to any one of Claims 15 to 20 wherein the finely
- 15 divided susceptor is incorporated in quantities up to 30% by weight with respect to the one of said layers.
22. The stratified material according to any one of Claims 15 to 21 wherein the finely
- divided susceptor is uniformly incorporated 20 throughout the one of said layers.
23. The stratified material according to any one of Claims 15 to 21 wherein the finely divided susceptor is incorporated in selected
- 25 areas of the one of said layers.
24. The stratified material according to any one of Claims 15 to 23 wherein one of said layers is joined to the other of said layers at selected locations on the latter.
25. A method of forming a material or 30 an article substantially as herein described with reference to the accompanying drawings.

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