(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2012 (15.11.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/154909 A2

(51) International Patent Classification:
C09J 167/08 (2006.01)

(21) International Application Number:
PCT/US2012/037224

(22) International Filing Date:
10 May 2012 (10.05.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/484,287 10 May 2011 (10.05.2011) US

(71) Applicant *(for all designated States except US)*: **SUN CHEMICAL CORPORATION** [US/US]; 35 Waterview Blvd., Parsippany, NJ 07054 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **JOHNKE, Christian** [DE/DE]; Herderstr 17, 60316 Frankfurt Am Main (DE). **FRISCHKORN, Jurgen** [DE/DE]; Wilhelmstrasse 20, 63526 Erlensee (DE).

(74) Agent: **BAILEY, Matthew, T.**; McKenna Long & Aldridge LLP, 1900 K Street NW, Washington, DC 20006-1108 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) **Title**: COLD FOIL ADHESIVES USED IN FOOD & NON FOOD PACKAGING APPLICATIONS

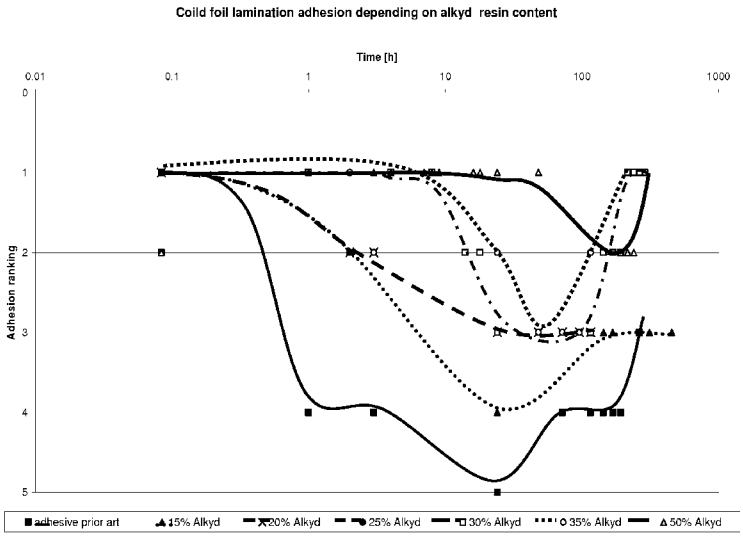

FIGURE 2

(57) **Abstract**: The present invention is directed to cold foil adhesives which include greater than or equal to about 15 wt. % alkyd, and a solvent. The adhesives may also include a modified rosin resin. The cold foil adhesives of the present application maintain acceptable adhesion ratings after cold foil lamination. The cold foil adhesives maintain acceptable adhesion after a cold foil lamination employing the adhesives.

WO 2012/154909 A2

COLD FOIL ADHESIVES USED IN FOOD & NON-FOOD PACKAGING APPLICATIONS

[0001] This application claims the benefit of United States Provisional Patent Application No. 61/484,287 filed May 10, 2011, which hereby is incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] Generally, the present invention is directed to cold foil adhesive compositions. The present invention also is directed to packages including the above-mentioned adhesive compositions for adhering metal foils to substrates such as primary or secondary packaging. The present invention further is directed to inks including the above-mentioned adhesive compositions.

Description of the Related Art

[0003] Adhesives are used in a multitude of industries and are of particular importance in printing technologies. An essential characteristic of adhesives is the ability to form bonds of measurable strength, *i.e.,* bond strength, with the surface of a material upon brief contact and pressure. Depending upon the end-use and desired printing application, varying levels of bond strength are preferred.

[0004] In the last decade, cold foil lamination technology has become one of the preferred vehicles for improving precision of images on packages. This is attributed flexibility and high registration accuracy. Specifically, cold foiling enables full-surface sheet decoration at high speeds when implemented in offset printing. Cold foiling eliminates the need for hot stamping causing deformed substrates. Outstanding flatness is thereby realized.

Cold foil lamination technology also eliminates opaque, white applications simply by omitting foil in certain areas of the substrate.

[0005] While there has been improved speed-to-market potential in view of short production times in cold foiling technology, migration of adhesive components has been an incessant problem in the art. Migration is especially undesired in food packaging applications. Migratory components in adhesive compositions, particularly from solvents, during oxidative drying, cause foul odor and taste of the contacted foodstuff. What is desired in the art is an adhesive composition which does not migrate or meets regulatory stands constituting food safety.

[0006] In conventional cold foil lamination applications, there has been a failure to maintain acceptable adhesion or time. Acceptable adhesion is defined as an adhesion rating less than or equal to about 3. Specifically, poor adhesion ratings are exhibited relatively soon, *e.g.,* in about an hour, after cold foil lamination. Poor adhesion ratings remain for an extended period of time thereafter. Hence, packages including conventional adhesives exhibit significantly lower industrial efficiency and speed-to-market since the laminated package must idly wait until adhesion reaches generally acceptable levels. What is desired is an adhesive which maintains acceptable adhesion, according to generally accepted tape test methods, extending directly after cold foil lamination through market implementation.

SUMMARY OF THE INVENTION

[0007] It has surprisingly been found by the inventors that their adhesive compositions exhibit significantly improved adhesion characteristics in cold foil applications. "Acceptable adhesion", defined as less than or equal to about 3 based on a tape test, is exhibited after metal foil lamination. Acceptable adhesion is maintained for a predetermined

amount of time. In an exemplary embodiment, acceptable adhesion is maintained for at least 5 hours after metal foil lamination.

[0008] One advantage of the present invention is the reduction and/or elimination of migratory components in the adhesive composition for food packaging applications.

[0009] In the present invention, there is described a cold foil adhesive composition including an alkyd in an amount greater than about 15 wt. %, in addition to one or more solvents. In an exemplary embodiment, the amount of alkyd is greater than or equal to about 20 wt. %. In yet another exemplary embodiment, the amount of alkyd is greater than or equal to about 30 wt. %.

[0010] In another exemplary embodiment, the adhesive composition includes one or more modified rosin resins or petroleum hydrocarbon resins.

[0011] The present invention also includes a package including the adhesive as described above. The package also includes a metalized foil laminated on the substrate. Specifically, the adhesive is printed on a surface of the substrate. The metalized foil is laminated onto the adhesive. In an exemplary embodiment, the substrate is a primary and/or secondary package. In a further, exemplary embodiment, the packaging is used in food packaging. In another, exemplary embodiment, the substrate is used in cosmetic packaging. In yet another embodiment, the substrate is used in pharmaceutical packaging.

[0012] In the present invention, there is described a method of manufacturing a package including a cold foil laminated onto a substrate. Specifically, an adhesive of the present invention is printed onto a surface of a substrate. A metal foil is laminated onto the adhesive such that acceptable adhesion, defined above as a rating less than or equal to about 3 based on a tape test, is maintained between the substrate and the metal foil for a sustainable period of time lasting at least 5 hours after lamination of the metal foil. In an exemplary embodiment, acceptable adhesion is maintained for at least 10 hours after lamination. In a

further exemplary embodiment, acceptable adhesion is maintained for at least 50 hours after lamination. In a further exemplary embodiment, acceptable adhesion is maintained for at least 100 hours after lamination. In yet a further exemplary embodiment acceptable adhesion is maintained for at least 300 hours after lamination.

[0013] Additional features and advantages of the present invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0015] In the Drawings:

[0016] **FIG. 1** illustrates adhesion values based on a tape test over time for an adhesive of the present invention compared with a conventional adhesive, *e.g.,* food safe, adhesive manufactured by Epple Printing Inks, used in cold foil laminates.

[0017] **FIG. 2** illustrates the adhesion values based on a tape test over time using different alkyd contents of the present invention compared with a conventional adhesive used in cold foil laminates, *e.g.,* food safe adhesive from Epple Printing Inks.

[0018] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and

variations of this invention provided they come within the scope of the appended claims and their equivalents.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Reference will now be made in detail to the embodiments of the present invention, and examples of which are illustrated in the accompanying figures.

[0020] The inventors of the present invention have discovered a new adhesive composition for cold foil lamination. The adhesive compositions can be used in the manufacture of inks or coatings. In an exemplary embodiment, the adhesive compositions can also be used in high-speed, sheet-fed offset printing processes.

[0021] In an exemplary embodiment, the adhesives of the present invention should preferably have a surface energy no greater than, and preferably equal to, the substrates upon which they are adhered for purposes of improving adhesion in cold foil adhesives and cold foil lamination applications. The surface energy relationship ensures strong mechanical adhesion, *e.g.,* bond strength, between the adhesive, substrate and metalized. The inventors have conceived adhesive compositions including a selection of one or more alkyds in amounts which impart long-lasting bond strength between the metalized foil and a substrate. As described herein, acceptable adhesion is identified as being less than or equal to about 3 on a scale of 0-5 in the tape test as described in more detail below. Adhesion lasting at least 5 hours, preferably at least 10 hours, more preferably at least 300 hours after lamination can be shown by the present invention. In an exemplary embodiment, the adhesion ratings remain "very good", *e.g.,* 4 or 5, through market implementation. **Figure 2** is an exemplary embodiment of food-safe adhesives imparting acceptable adhesion levels over an extended period of time. In order for adhesives to be food-safe, all of the components therein must be capable of contacting food and being non-toxic or odorous to humans. Otherwise, the

components of the adhesive must be low migration as commonly understood in the art. In an exemplary embodiment, the adhesives conform to food safety or low migration regulations in accordance with United States 37 CFR § 175 titled, "INDIRECT FOOD ADDITIVES: ADHESIVES AND COMPONENTS OF COATINGS", specifically subsection 105 relating to "Adhesives".

[0022] The adhesive composition of the present invention may preferably include, some or all of the following components: alkyds, solvents, modified rosin resins, petroleum hydrocarbon resins, colorants and metal driers. For actinic radiation or energy curable UV packaging applications such as ultraviolet or electron beam activated monomers, oligomers, and photoinitiators may also be included in the adhesive composition.

Alkyds

[0023] Alkyds are thermosetting polymers chemically similar to polyester resins. Alkyds also are modified polyesters by the addition of fatty acids and other components. In the present invention, alkyds are typically present in molecular weights ranging from about 5,000 to 20,000. In another embodiment, the molecular weight is less than 10,000. In an exemplary embodiment, the alkyd is a liquid oligomer.

[0024] In one embodiment, an alkyd is the reaction product between a polyhydric alcohol and an acid or acid anhydride. The alkyds are modified with fatty acids, saturated or unsaturated, preferably from plant and vegetable oils. Consequently, "oil-modified" is used herein to refer to an alkyd containing fatty acid modifications of the resin. Non-limiting examples of such acids include adipic acid. Alternatively, the acid may be sebatic acid. Alternatively, the acid may be lauric acid. Alternatively, the acid may be stearic acid. Alternatively, the acid may be myristic acid. Alternatively, the acid may be palmitic acid. Alternatively, the acid may be oleic acid. Alternatively, the acid may be linoleic acid.

Alternatively, the acid may be sebacic acid. Alternatively, the acid may be citric acid. Alternatively, the acid may be oxalic acid. Alternatively, the acid may be malonic acid. Alternatively, the acid may be succinic acid. Alternatively, the acid may be glutaric acid. Alternatively, the acid may be maleic acid. Alternatively, the acid may be fumaric acid. Alternatively, the acid may be phthalic acid. Alternatively, the acid may be isophthalic acid. Alternatively, the acid may be terephthalic acid. Alternatively, the acid may be acrylic acid. Alternatively, the acid may be methacrylic acid. Alternatively, the acid may be itaconic acid. Alternatively, the acid may be glycidyl methacrylate. Alternatively, the acid may be combination of any of the acids mentioned above.

[0025] Also suitable are alkyds produced as polyesters based on polyvalent acids and alcohols modified with fatty acids such as caproic acid. Alternatively, the acid may be caprylic acid. Alternative, the acid may be capric acid. Alternatively, the acid may be lauric acid. Alternatively, the acid may be myristic acid. Alternatively, the acid may be palmitic acid. Alternatively, the acid may be stearic acid. Alternatively, the acid may be arachidic acid. Alternatively, the acid may be behenic acid. Alternatively, the acid may be tetradecanoic acid. Alternatively, the acid may be hexadecanoic acid. Alternatively, the acid may be oleic acid. Alternatively, the acid may be erucic acid. Alternatively, the acid may be linolic acid. Alternatively, the acid may be linoelaidic acid. Alternatively, the acid may be eleostearic acid. Alternatively, the acid may be timnodonic acid. Alternatively, the acid may be arachidonic acid. Alternatively, the acid may be clupanodonic acid. Alternatively, the acid may be ricinolic acid. Alternatively, the acid may be artificial acids such as ricinelaidic acid. Alternatively, the acid may be versatic acid. Alternatively, the acid may be hydroxystearic acid. Alternatively, the acid may be combinations of those mentioned above.

[0026] While it is known that any of the above-mentioned alkyds may be used for non food packaging applications, the following alkyds are exemplary embodiments of non food-safe packaging applications in accordance with the present invention. Particularly, the alkyd may be prepared by a reaction at least containing an oil. One example is tall oil. Alternatively, the alkyd may include soya oil. Alternatively, the alkyd may include sunflower oil. Alternatively, the alkyd may include rapeseed oil. Alternatively, the alkyd may include corn oil. Alternatively, the alkyd may include tung oil. Alternatively, the alkyd may include linseed oil. Alternatively, the alkyd may include coconut oil. Alternatively, the alkyd may include palm oil. Alternatively, the alkyd may include peanut oil. Alternatively, the alkyd may include cotton oil. Alternatively, the alkyd may include castor oil. Alternatively, the alkyd may include jatropa oil. Alternatively, the alkyd may include olive oil. Alternatively, the alkyd may include grape oil. Alternatively, the alkyd may include sesame oil. Alternatively, the alkyd may include fish oil. Alternatively, the alkyd may include tallow oil. Alternatively, the alkyd may include oiticica oil. Alternatively, the alkyd may include safflower oil. Alternatively, the alkyd may include perilla oil. Alternatively, the alkyd may be any combination of those mentioned above.

[0027] In another embodiment, alkyds are produced whereby vegetable oil is trans-esterified by the addition of a polyol. The polyol may be glycerol in an exemplary embodiment. The formed product is a mixture of mono- and diglycerides of these oils. A polyvalent acid, such as, for example, isophthalic acid, is then used to react with the mono- and diglycerides to form alkyd resins.

[0028] Alternatively, the alkyd is modified with acrylic acid. Alternatively, the alkyd is modified with methacrylic acid and hydrocarbon resins. Alternatively, the alkyd is modified with styrene. Alternatively, the alkyd is modified with vinyl toluene. Alternatively, the alkyd is modified with silicone. Alternatively, the alkyd is modified with epoxy.

Alternatively, the alkyd is modified with polyamides. Alternatively, the alkyd is modified by any combination of those mentioned above.

[0029] In another exemplary embodiment, the alkyd is selected such that it is acceptable in food packaging applications. Such alkyds preferably contain natural oils with a low content of unsaturated fatty acids, *e.g.,* coconut oil. Such fatty acids are capable of migration. These alkyds help the adhesive's overall stability against oxidation. By so doing, odorous decomposition products can be avoided.

[0030] In yet another embodiment, as applicable in food packaging applications, the alkyd may be formed via hydrogenation. One example is hydrogenated rapeseed oil. Another example is hydrogenated ricinolic acid (1,2-hydroxy stearic acid). Such alkyds are sterically hindered and therefore do not migrate.

[0031] Non-limiting examples of acids for food packaging applications include saturated acids such as propionic acid. Alternatively, the saturated acid is butyric acid. Alternatively, the saturated acid is valeric acid. Alternatively, the saturated acid is caproic acid. Alternatively, the saturated acid is caprylic acid. Alternatively, the saturated acid is capric acid. Alternatively, the saturated acid is lauric acid. Alternatively, the saturated acid is myristic acid. Alternatively, the saturated acid is palmitic acid. Alternatively, the saturated acid is stearic acid. Alternatively, the saturated acid is arachidic acid. Alternatively, the saturated acid is behenic acid. Alternatively, the saturated acid is lingnoceric acid. Alternatively, the saturated acid is cerotic acid. Alternatively, the saturated acid is montanic acid. Alternatively, the saturated acid can be any combination of those mentioned above.

[0032] In an exemplary embodiment, the alkyd content of the adhesive composition preferably is greater than about: 15 wt. %; 16 wt. %; 17 wt. %; 18 wt.%; 19 wt. %; 20 wt. %; 21 wt. %; 22 wt. %; 23 wt. %; 24 wt. %; 25 wt. %; 26 wt. %; 27 wt. %; 28 wt. %; 29 wt. %; 30 wt. %; 31 wt. %; 32 wt. %; 33 wt. %; 34 wt. %; 35 wt. %; 36 wt. %; 37 wt.

%; 38 wt. %; 39 wt %; 40 wt. %; 41 wt. %; 42 wt. %; 43 wt. %; 44 wt %; 45 wt %; 46 wt %; 47 wt. %; 48 wt. %; 49 wt. %; 50 wt. %; 51 wt. %; 52 wt. %; 53 wt. %; 54 wt. %; 55 wt. %; 56 wt. %; 57 wt. %; 58 wt. %; 59 wt. %; 60 wt. %; 61 wt. %; 62 wt. %; 63 wt. %; 64 wt. %; 65 wt. %; 66 wt. %; 67 wt. %; 68 wt. %; 69 wt. %; 70 wt. %; 71 wt. % 72 wt. %; 73 wt. %; 74 wt. %; 75 wt. %; 76 wt. %; 77 wt. %; 78 wt. %; 79 wt. %; 80 wt. %; 81 wt. %; 82 wt. %; 83 wt. %; 84 wt. %; 85 wt. %; 86 wt. %; 87 wt. %; 88 wt. %; 89 wt. %; 90 wt. %.

[0033] In an exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 90 wt. %. In another exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 80 wt. %. In another exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 70 wt. %. In another exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 60 wt. %. In another exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 50 wt. %. In another exemplary embodiment, the alkyd content is greater than about 30 wt. % and less than about 40 wt. %.

[0034] In yet another exemplary embodiment, the alkyd content is greater than about 40 wt. % and less than about 70 wt. %. In another exemplary embodiment, the alkyd content is greater than about 40 wt. % and less than about 60 wt. %. In another exemplary embodiment, the alkyd content is greater than about 40 wt. % and less than about 50 wt. %.

[0035] In another exemplary embodiment, the alkyd content is greater than about 50 wt. % and less than about 90 wt. %. In another exemplary embodiment, the alkyd content is greater than about 50 wt. % and less than about 80 wt. %. In another exemplary embodiment, the alkyd content is greater than about 50 wt. % and less than about 70 wt. %. In another exemplary embodiment, the alkyd content is greater than about 50 wt. % and less than about 60 wt. %.

Solvents

[0036] Solvent also are important to the adhesive composition. Selection of the solvent is dependent upon whether the application is for food or non food packaging. It is generally understood that solvents used in food packaging can also be used in non-food packaging applications.

[0037] For non food packaging applications, various types of solvents are suitable, including but not limited to mineral oils, vegetable oils, fatty acid esters, ethers, or combinations thereof. Also considered suitable are solvents used for offset inks. For examples, similar solvents as described in Applicants' earlier invention U.S. 2010/0174020 titled, "SHEET-FED OFFSET PRINTING INKS AND VARNISHES COMPRISING NEW SOLVENTS" may also be used and are incorporated herein.

[0038] For food packaging applications, the solvent preferably is selected such that it does not belong on an exclusion list in the European Union, or regulated by the United States Food and Drug Administration Act (FDA). Namely, the solvents are either food safe, *e.g.*, ability to contact food, or low migration. In one embodiment, solvents include, but are not limited to, saturated oils, similar to those used in foods. In an exemplary embodiment, medium chain triglycerides (MCTs), and esters of fatty acids such as propylene glycol of solvents.

[0039] In another embodiment, solvents exhibiting low migration properties are suitable for use in food packaging applications. Because a significant aspect of migration originates from solvents or oils, compounds with larger molecular size and/or sterically hindered molecules are especially preferred. Some examples of solvents include, but are not limited to, esters of trimellitic acid, fatty acid ester of pentaerithritol, esters of acetylated citric acid ATOC, or combinations thereof. Since the solvents do not migrate, odor and foul taste of foods are prevented inside the primary or second packaging.

[0040] In an exemplary embodiment, solvents such as tri-octyl/decyl-trimellitate (TODTM), tri-2-ethylhexyl Trimellitate (TOTM) and pentaerythritol esters of saturated fatty acids may also be used in food packaging applications. Namely, these solvents do not migrate in view of their high molecular weight.

Tackifier Additives

[0041] Adhesive compositions are sometimes prone to undesirable softness and/or cracking after subsequent application of inks or foils. For purposes of bolstering strength, toughness and film forming properties, the adhesive compositions of the present application may optionally include tackifier additives such modified rosin resins and/or petroleum hydrocarbon resins. The modified rosin resins or petroleum resins may be added individually, or as a component of a varnish, into the adhesive composition. The molecular weight of these components typically range from about 10,000 to about 200,000. In yet another exemplary embodiment, these modified rosin resins and/or petroleum hydrocarbon resins are solid. In an exemplary embodiment, these components are hard or brittle.

[0042] By contrast with the above-mentioned alkyds which are typically produced from natural oils, such as vegetable oils, the petroleum hydrocarbon resin can be C5/C9 aromatic hydrocarbons. An exemplary embodiment of the petroleum hydrocarbon resin is commercially provided by Arakawa Chemical Industries, Limited. For example, Arkon P125 is colorless, transparent resin with excellent UV and thermal stability.

[0043] In one embodiment, the modified rosin resin can include a modified maleic rosin resin. Alternatively, it can include a modified phenolic rosin resin. Alternatively, it includes a modified fumaric rosin resin. In another embodiment, resin is a hydrocarbon resin. Alternatively it is a hydrocarbon rosin hybrid resin. Alternatively it is a phthalate resin. Alternatively it is a ketone resin. Alternatively it is a urethane resin. Alternatively it is an

epoxy resin. Alternatively it is a urea formaldehyde resin. Alternatively it is a phenolic resin. Alternatively, it is a maleic resin. Alternatively it is a fumaric resin. Alternatively it is a transesterified resin. Alternatively it is a cumarone indene resin. Alternatively it is a butadiene/pentadiene derivate resin. Alternatively it is a polyamide resin. Alternatively, the resin is a combination of any those described above.

[0044] For food packaging applications, preferred high molecular weight resins and/or modified rosin resins include, but are not limited to, modified maleic resin rosins, phenolic modified rosin resins, maleic resins and and hydrocarbon resins.

Energy Curable Materials

[0045] The adhesives of the present application may also contain energy curable materials. In one embodiment, the adhesives contain at least one alpha, beta ethylenically unsaturated, radiation polymerizable group. In an exemplary embodiment, there is an oligomer or monomer containing two or more terminal, or pendent, alpha, beta ethylenically unsaturated groups linked through a polymeric backbone, or through similar linking groups to a central aliphatic or aromatic backbone. The compounds may include but are not limited to an epoxy acrylate, an epoxy methacrylate, a polyether acrylate, a polyether methacrylate, a polyester acrylate, a polyester methacrylate, a polyurethane acrylate, a polyurethane methacrylate, a melamine acrylate, a melamine methacrylate, or combinations thereof.

[0046] Such components may be cured by exposure to actinic radiation, *e.g.,* UV radiation and electron beam. In one embodiment, for example, a UV binder wherein a backbone molecule is modified with an acrylic acid, methacrylic or vinyl group is employed. The backbone molecule can be a polyester, epoxy resin, bisphenol, urethane acrylate, melamine, benzuguanamine, etc. The binder may be an epoxide group containing molecule having an initiator, which produces a cation, *e.g.,* strong acid under UV light. As a UV

initiator, all free radical or cationic initiators are suitable. In an exemplary embodiment, the direct use of reactive diluents such as, for example, TMPTA, GPTA, PETA, HDDA, with alkyd resin also is possible.

Additional Additives

[0047] As with most printing inks, other additives, alone or in combination may be employed, including but not limited to, driers, colorants, waxes, stabilizers, silicones, rheological modifiers, plasticizers, gelling agents, and the like.

[0048] In non-food applications, it is possible to improve adhesion by introducing metal-based driers. In one embodiment, the metal-based driers are typically present in amounts less than or equal to about 1 wt. % based on the weight of the adhesive composition. In an exemplary embodiment, the metal-based driers are usually metal salts of organic acids including, but not limited to, neodecanoic acid, octanoic acid, or combinations thereof. The metal part of the drier can be based on metals such as Co, Mn, Ce, Zr, V, Fe, Ca, K, Sr, etc. In another embodiment, metal driers based on borates including but not limited to cobalt borate or activated/chelated driers such as manganese bipyridyl can be used.

[0049] The adhesives of the present application may optionally also contain colorants. In one embodiment, the adhesive composition includes less than about 10 wt. %, more preferably less or equal to about 6 wt. % colorants. The use of colorants can allow for improved optical density measurements and better control of film weight in comparison to adhesives that do not contain colorants.

[0050] The colorant may be any pigment that can be employed in printing inks. It may be organic or inorganic and may be a dye or pigment. Examples of suitable colorants include, but are not limited to, inorganic pigments, such as Pigment White 6 (Titanium Dioxide), Pigment Black 7 (carbon black), Pigment Black 11 (Black Iron Oxide), Pigment

Red 101 (Red Iron Oxide) and Pigment Yellow 42 (Yellow Iron Oxide), and organic pigments such as Pigment Yellow 1, Pigment Yellow 3, Pigment Yellow 12, Pigment Yellow 13, Pigment Yellow 14, Pigment Yellow 17, Pigment Yellow 37, Pigment Yellow 63, Pigment Yellow 65, Pigment Yellow 73, Pigment Yellow 74, Pigment Yellow 75, Pigment Yellow 83, Pigment Yellow 97, Pigment Yellow 98, Pigment Yellow 106, Pigment Yellow 114, Pigment Yellow 121, Pigment 26Yellow 126, Pigment Yellow 136, Pigment Yellow 174, Pigment Yellow 176, Pigment Yellow 188, Pigment Orange 5, Pigment Orange 13, Pigment Orange 16, Pigment Orange 34, Pigment Red 2, Pigment Red 9, Pigment Red 14, Pigment Red 17, Pigment Red 22, Pigment Red 23, Pigment Red 37, Pigment Red 38, Pigment Red 41, Pigment Red 42, Pigment Red 112, Pigment Red 146, Pigment Red 170, Pigment Red 196, Pigment Red 210, Pigment Red 238, Pigment Blue 15, Pigment Blue 15:1, Pigment Blue 15:2, Pigment Blue 15:3, Pigment Blue 15:4, Pigment Green 7, Pigment Green 36, Pigment Violet 23, FD&C pigments and the like. The dyes include but are not limited to azo dyes, anthraquinone dyes, xanthene dyes, azine dyes, FD&C dyes, or combinations thereof and the like.

Substrates

[0051] Examples of substrates suitable for use in the present invention include but are not limited to cellulosic materials. One example of cellulosic material is paper. In another example, the substrate is paperboard. An alternative example is cardboard. It is understood that in cold foil laminations, the substrate can be different from metal foil. Namely, the substrate and metal foil have dissimilar surface properties.

[0052] While the adhesives of the present invention may independently be used in various applications including but not limited to cold foil lamination, the adhesives may also be implements as components in other compositions and products. In an exemplary

embodiment, the adhesives are used in coatings. In another exemplary embodiment, the adhesive composition is used in ink formulations. In an exemplary embodiment, the ink formulation may include a pigment or dye colorant

[0053] The adhesive compositions may also be used in a variety of other industrial applications. In one embodiment, the adhesives are used in food packaging applications. In another embodiment, the adhesives are used in non-food packaging applications. In an exemplary embodiment, the adhesives are used in self-adhesive labels. In an alternative, exemplary embodiment, the adhesives are used in paper labels. In a further exemplary embodiment, the adhesives are used in pharmaceutical packaging applications. In yet a further exemplary embodiment, the adhesives are used in cosmetic packaging applications. In yet another exemplary embodiment, the adhesives are used in luxury packaging. In another exemplary embodiment the adhesives are used in holograms or hologram foils. In another embodiment, the adhesives are used wrapping paper, book covers, greeting cards, business cards or magazine coves.

[0054] In another embodiment, there is described a method of manufacturing a package including a cold foil laminated onto a substrate exhibiting improved adhesion. During the cold foil lamination process, a metal foil is transferred and maintained onto a substrate by employing the adhesives of the present invention. Generally, a standard printing plate transfers the adhesive onto pre-designated areas of a substrate to be decorated. The substrate with adhesive applied thereon is transferred to another print unit for applying foil. The adhesive printed on the substrate is brought into contact with the cold foil by applying pressure with cylinders to precisely transfer the cold foil onto the cold foil printed areas of the substrate. The cold foil, *e.g.,* metalized layer of the foil, also can be overprinted in multiple colors in subsequent printing units. Hence, many different design effects can be realized.

[0055] In yet another exemplary embodiment, the cold foil lamination process includes actinic radiation technology, either via electron beam or ultra violet curing. UV curing requires the implementation of UV components such as UV binders, monomers, oligomers, reactive diluents and photoinitiators in the adhesive. In another embodiment, there is described an ink including the adhesive having UV components.

[0056] In an exemplary embodiment, the acceptable adhesion, *e.g.,* less than or equal to a rating of about 3 via a tape test, is exhibited by the adhesive after lamination of the metal foil onto the substrate. Specifically, the adhesion strength of the adhesives were obtained by adhering Tesafilm Transparent 57379 tape to the metal foil laminated onto the substrate. The tape was immediately removed after its application and examined to determine the amount of metal foil laminate remaining on the substrate. Adhesion remained acceptable for at least 48 hours after lamination. In another embodiment, adhesion remained acceptable, for at least 120 hours after lamination. In another embodiment, adhesion remained acceptable, for at least 120 hours after lamination. In an exemplary embodiment, acceptable adhesion was maintained after lamination through market implementation.

[0057] In yet a further exemplary embodiment, there is described cold foil adhesive laminated packages capable of exportation to a customer in less than one week. There is also described cold foil adhesive laminated packages capable of exportation to a customer in less than 24 hours.

[0058] In yet another embodiment, there is described a package including adhesive compositions of the present invention, a substrate, such as primary or secondary packaging, and metal foil laminated onto the substrate. The foil may be an image located on a specific location of the primary or secondary package for anticipated, visual appeal by consumers.

[0059] The present invention has been described in detail, including the preferred embodiments thereof. However, it will be appreciated that those skilled in the art, upon

consideration of the present disclosure, may make modifications and/or improvements on this invention that fall within the scope and spirit of the invention.

RESULTS AND DISCUSSION

[0060] The following examples illustrate specific aspects of the present invention and are not intended to limit the scope thereof in any respect and should not be so construed.

[0061] As shown below in **Table 1**, the inventors varied the alkyd content to determine the most optimal bond strength based on a tape adhesion test. The adhesive materials in Table 1 at least include a varnish having a modified maleic rosin resin in MCT oil, a black toning base and a coconut alkyd. While Comparative Example 1, does not include an alkyd, each of examples 2-7 disclose coconut alkyd amounts of 15, 20, 25 30, 35 and 50 wt. %, respectively. Example 7 exhibited the lowest Laray viscometer value and best adhesion between 5 minutes and 264 hours. Examples 3 and 4 exhibited the lowest adhesion ratings of the group during this period.

[0062] The sample preparation and tape adhesion tests were conducted at various times beginning, for example, 5 minutes after lamination, and extending 264 hours after lamination. The amount of film remaining on the surface of the substrate was assess on a scale of 1 to 5 wherein 1 is excellent. Ratings of 2, 3 are assigned for intermediate amounts of removal of metalized film and considered acceptable for market implementation. Market implementation may include use of the adhesives in cold foil applications by a customer or customers. In another exemplary embodiment,

[0063] Adhesion ratings of 4 and 5 are considered poor and not acceptable for market implementation. The adhesives were printed on Invercote G 230 g/m^2 board substrate. These trials were performed in the lab using a Prüfbau proof printer. Example 7 was then tested on a MAN Roland 700 sheetfed offset press was typically used for printing

adhesives onto the substrate. Lamination was carried out with a Printdoor lamination unit using Luxor KPS gold and Aluffin silver foil (Kurz Transfer Products).

Table 1

Cold Foil Adhesives at Different Alkyd Levels for Food Packaging Applications (Examples 1-7)

Material	Description	Comp Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7
Varnish	Modified maleic rosin resin in MCT oil	94	79	74	69	64	59	44
SunPak FSB50	Black toning base MCT	6	6	6	6	6	6	6
Setalin V414	Coconut alkyd	-	15	20	25	30	35	50
Mixed with Haushield high speed mixer for 3 min. @ 3000 rpm								
Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**
Laray viscometer 25°C		484	356	350	304	301	258	220
Yield		607	583	1564	1462	737	1468	612
Tackoscope 200rpm		323	345	325	333	362	338	260
		Tape Adhesion (1=excellent 5=poor)						
Time	5 min	1	1	1	1	1	1	1
	1 hr	3	1	-	-	1	-	1
	2 hr	3	-	2	2	1	2	1
	6 hr	3	3	-	-	1	-	1
	18 hr	3	-	-	-	2	-	1
	24 hr	-	-	3	3	3	2	1
	48 hr	-	-	3	3	3	3	1
	96 hr	3	3	3	3	2	3	1
	120 hr	3	-	3	3	3	2	1
	168 hr	-	-	-	-	-	-	1
	192 hr	2	3	-	-	2	-	2
	216 hr	1	1	-	-	1	-	1
	264 hr	1	1	-	-	1	-	1

[0064] According to **Table 1,** acceptable adhesion was obtained with a preferred alkyd content of between about 30-50 wt. %. Higher and lower amounts may still produce acceptable results in many cases. The samples in **Table 1** preferably are used in food applications.

Table 2

Cold Foil Adhesives Based on Various Types of Resins and Varying Amounts of Alkyd for Food Packaging Applications

(Examples 8-14)

Material	Description	Ex. 8	Ex. 9	Ex. 10	Ex. 11	Ex. 12	Ex. 13	Ex. 14
Varnish	Maleic resin in TODTM*	-	44	24	-	-	-	-
Varnish	Modified phenolic rosin resin in TODTM*	-	-	-	-	44	-	-
Varnish	Modified phenolic rosin resin in MCT oil**	44	-	-	-	-	-	-
Resink 3295	Modified phenolic rosin resin	-	-	-	-	-	-	20
Arkon P125	Hydrocarbon resin	-	-			-	29	-
Waglinol 2/7680	Propylenglycol Capryl/Capric ester	-	-			-	15	24
Sunpak LMB50	Black base dispersion in TODTM*	-	6	6	-	6	6	6
Sunpak FSB50	Black base dispersion in MCT**	6	-	-	10	-	-	-
Setalin V414	Coconut alkyd	50	50	70	90	50	50	50
Mixed with Haushield high speed mixer for 3 min. @ 3000 rpm								
Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**
Tackoscope 200rpm		267	330	382	435	344	-	-
Viscosity 2 1/s	Rotational viscometer PP20	25.69	26.79	28.47	34.59	27.78	-	-
Viscosity 50 1/s	Rotational viscometer PP20	20.67	24.7	27.28	34.41	25.89	-	-
		Tape Adhesion (1=excellent 5=poor)						
Time	5 min	1	1	1	1	2	1	1
	1 hr	1	1	1	-	1	1	1
	2 hr	-	1	1	1	1	1	1
	3 hr	1	1	1	1	1	1	1
	15 hr	2	1	1	1	1	1	1
	24 hr	2	1	1	1	1	1	1
	96 hr	2	1	1	1	1	1	1
	120 hr	2	1	1	2	1	1	1

*TODTM= Trioctyl/decyl trimellitate **MCT= Medium chained triglyceride

[0065] **Table 2** illustrates varying amounts of alkyd in combination with different resin types and solvents yielding adhesives with acceptable adhesion. As disclosed in **Table 2**, the varnishes, *e.g.,* solvents and modified rosin resins and/or high molecular weight resins includes maleic resin in Trioctyl/decyl trimellitate (TODTM), phenolic modified resin in TODTM; and phenolic modified resin in medium chained triglyceride (MCT) oil. TODTM functions somewhat similar to MCT. The difference is TODTM is non-migrating whereas MCT can migrate and contact food without odor or taste concerns. The weight percentage of

varnish varies between about 24 to 44 wt. %. The amount of coconut alkyd resin is varied between 50 and 70 wt. %. The amount of toning base varies between 6 to 10 wt. %. The samples in Table 2 preferably are used in food packaging applications.

[0066] The adhesives were tested using a standard tape adhesion procedure. Each of examples 8-12 and 14 includes at least one or more modified rosin resins. Example 13 includes one or more petroleum hydrocarbon resins.

[0067] Examples 9 and 10 exhibited the best adhesion ratings of examples 8-14. Each of examples 9 and 10 include both an alkyd and one or more modified rosin resins. Example 11 did not include any high molecular weight resins and/or modified rosin resins. In comparison with examples 9 and 10, example 11 exhibits a slightly less favorable adhesion rating at extended time intervals, *i.e.,* 120 hours. Example 12 includes a phenolic modified rosin resin in TODTM in an amount of 44 wt. %. Soon after lamination, *i.e.,* about 5 minutes, adhesion ratings are slightly less than in Examples 9 and 10.

Table 3

Cold Foil Adhesives Based on Various Materials in Non Food Packaging Applications (Example 13-23)

Material	Description	Ex. 15 (UV)	Ex. 16	Ex. 17*	Ex. 18	Ex. 19	Ex. 20	Ex. 21	Ex. 22	Ex. 23	Ex. 24	Ex. 25
Fineplus AL 7310	Soya bean oil alkyd	-	50	50	-	-	-	-	-	-	-	-
Setalin V 465	Linseed oil alkyd	-	-	-	50	-	-	-	-	-	-	-
Unithane 6625	Urethane modified linseed alkyd	-	-	-	-	50	-	-	-	-	-	-
Synkyd E50	Hydrocarbon modified alkyd	-	-	-	-	-	50	-	-	-	-	-
Necomar FW2000	Fish oil alkyd	-	-	-	-	-	-	50	-	-	-	-
setalin v414	Coconut alkyd	68	-	-	-	-	-	-	50	50	50	50
Sartomer CN2555	UV Polyesteracrylate	30	-	-	-	-	-	-	-	-	-	-
Irgacure 369	UV initiator	2	-	-	-	-	-	-	-	-	-	-
Varnish	Modified phenolic rosin resin in Mineral/linseed oil	-	44	43.7	44	44	44	44	-	-	-	-
Varnish	Modified phenolic rosin resin in Woodoil	-	-	-	-	-	-	-	44	-	-	-
Varnish	Modified phenolic rosin resin in RME/soya oil	-	-	-	-	-	-	-	-	44	-	-
Varnish	Mineral oil transestrified resin	-	-	-	-	-	-	-	-	-	44	-
Varnish	Veggie Ester + Maleic + HC resin	-	-	-	-	-	-	-	-	-	-	44
Borchers 0411Hs	Manganese drier	-	-	0.3	-	-	-	-	-	-	-	-
SunPak LMQ Black	Black base TODTM*	6	6	6	6	6	6	6	6	6	6	6
Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Time	5 min	1	1	1	1	1	1	1	1	1	1	1
	10 min	1	1	1	1	1	2	1	1	1	1	1
	1 hr	1	1	1	1	1	1	1	1	1	1	1
	24 hr	1	1	1	1	1	1	1	1	1	1	1
	96 hr	1	1	1	1	1	1	1	1	1	1	1

[0068] In **Table 3**, at least examples 16-25 includes or more modified rosin resins. Modified phenolic rosin resin is used in at least examples 16-23. Modified maleic rosin resin is used in examples 24 and 25.

[0069] Example 17 exhibited better adhesion than Examples 15, 16 and 18-25 due to the presence of the manganese drier. Though a tape adhesion rating of 1 was assigned to

nearly all of the examples, most of them showed trace amounts of removal during tape testing. Example 17 did not show any removal and thus was gauged to be very good/superior.

[0070] **Table 3** illustrates results obtained using various alkyds and resin combinations, as well as specific examples incorporating a metal drier and a UV-curable formulation. Each of examples 15-25 includes a toning base in an amount of about 6 wt. % for improving visibility. Namely, the tone base is SunPak LMQ Black LMB50.

[0071] The alkyds tested in Examples 15-25 include: soya bean oil alkyd, linseed oil alkyd, urethane modified linseed alkyd, hydrocarbon modified alkyd, fish oil alkyd, and coconut alkyd. Examples 15-25 comprise about 50 wt. % of an alkyd, and example 15 comprises about 68 wt. % of an alkyd, based on the total weight of the adhesive composition.

[0072] Example 15 is a UV-curable formulation including about 68 wt. % coconut alkyd. Example 15 also includes about 30 wt. % of Polyesteracrylate and 2 wt.% photoinitiator based on the total weight of the adhesive composition.

[0073] While both examples 16 and 17 include soya bean oil alkyd and a phenolic modified rosin resin in mineral/linseed oil, example 17 includes about 0.3 wt. % of a manganese drier. As described in **Table 3**, example 17 exhibits the best adhesion of all tested examples. This is most attributed to the metal drier additive.

[0074] The adhesion experiments for examples 15-25 were conducted at five time intervals including 5 min, 10 min, 1 hour, 24 hours and 96 hours. The test was based on a scale of 1 through 5 with 1 being excellent and 5 being poor. As mentioned above, Example 18 exhibited the most optimal curing characteristics in view of the metal drier additive. While each of Examples 16-26 exhibited overall excellent tape adhesion, Example 20 exhibited a rating of 2 when tested after 10 minutes of application.

Example Formulas Showing Preferred Embodiments

[0075] For non food packaging applications, exemplary components of the adhesive include soya bean oil alkyd combined with a varnish composed of a phenolic modified resin in mineral oil. The amount of soybean oil alkyd in this formulation is preferably 15-70 wt. %, more preferably 30-50 wt. %. For accelerated drying, the addition of a siccative, *e.g.,* metallic drier, is recommended. The siccative as metal salt can be based on various metals like Co, Mn, Fe, V, Ce, St, Ca, Zr, but preferably is a manganese drier in amount of 0.1-3 wt. %, more preferable 0.2-0.5 wt. %. To facilitate better visibility and assessment of the film weight of transferred adhesive by optical density measurement, the incorporation of a colorant or toning base is recommended. Most preferable is a black toning base for silver foil lamination, and yellow or orange base for gold lamination, but other color schemes are also possible.

Table 4

Adhesive Formula of Non Food Packaging Example 17

Raw Material	Supplier	Description	Wt. %
Fineplus AL 7310	DPR	soya bean oil alkyd	50
Exxprint M74a	Exxon	Mineral oil	20.6
Linseed oil	Alberdingk	Linseed oil	4.5
Resink 4252	Respol	Modified phenolic rosin resin in Mineral/linseed oil	18.6
Mix and heat to 180°C, hold for 20 min, cool to 80°C			
Borchers 0411Hs	Borchers	Manganese drier	0.3
Black toning base MSB50	Sun Chemical	Black base MS4C	6
Mix with Haushield high speed mixer for 3 min. @ 3000 rpm			
Total			100

[0076] For an adhesive to be used for food packaging applications, the most preferred materials include a coconut oil alkyd resin in an amount of 15-70% more preferably 30-60% combined with a varnish composed of a maleic rosin resin selected from trioctlydecyl trimellitate (TODTM) solvent or tri glycerol caprylic/caprinic ester. To facilitate

better visibility and assessment of the film weight of transferred adhesive by optical density measurement, the incorporation of a colorant or toning base is recommended. Most preferable is a black toning base for silver foil lamination, and yellow or orange base for gold lamination, but other color schemes are also possible. Two preferred embodiments are shown in **Table 5 and 6** below. Table 5 describes components of Example 5. Table 6 describes the components of Example 12.

Table 5

Adhesive Formula for Food Packaging Example 5

Raw Material	Supplier	Description	%
Setalin V414	Hexion	Coconut oil alkyd	30
Bergabest MCT Oil 60/40	Sternchemie	Tri glycerol caprylic/caprinic ester	33
Resink 1256	Respol	Transesterified maleic resin	17.0
Arez RE3010	Arez	Modified maleic rosin resin	13.4
M4801:LMQ antioxidant solution	Sun Chemical	BHT 40% in TODTM	0.6
Mix and heat to 180°C, hold for 20 min, cool to 80°C			
Black base LMB50	Sun Chemical	Black base Low migration	6
Mix with Haushield high speed mixer for 3 min. @ 3000 rpm			
Total			**100**

Table 6

Adhesive Formula for Food Packaging Example 12 from Table 2

Raw Material	Supplier	Description	%
Setalin V414	Hexion	Coconut oil alkyd	50
Linplast 810	Sasol	Trioctlydecyl trimellitate	14
Coconut oil	Gustav Hees	Coconut oil	14.5
Arez RE3010	Arez	Modified maleic rosin resin	15.5
Mix and heat to 180°C, hold for 20 min, cool to 80°C			
Black base LMB50	Sun Chemical	Black base Low migration	6
Mix with Haushield high speed mixer for 3 min. @ 3000 rpm			
Total			**100**

[0077] **Figure 1** illustrates a comparison between an inventive cold foil adhesive and a prior art cold foil adhesive from Epple for a predetermined period of time. The

inventive cold foil adhesive is based upon example 7. The prior art adhesive is commercially available Kaltfolienkleber 1798 (Epple). Adhesion rating was assessed by tape test as described above. As shown, the inventive adhesive including an alkyd exhibits improved adhesion between 0.1 hours through about 500 hours. An adhesion rating of 2 or better was exhibited for the inventive adhesive. By contrast, the prior art adhesive exhibited a significant degradation in adhesive quality between 0.1 hours and about 300 hours. During this time period, the lowest adhesion rating of 5 was exhibited by the prior art adhesive suggesting very poor adhesive characteristics. As mentioned above, acceptable adhesion is defined by an adhesion rating less than or equal to about 3.

[0078] **Figure 2** illustrates the adhesive strength of 6 adhesives according to the present invention in addition to a prior art adhesive. The prior art adhesive is the same adhesive in Figure 1. The inventive adhesives vary in alkyd content between about 15 and 50 wt. %. As shown in **Figure 2**, Example 7 exhibits the best adhesion results of all the inventive examples. Namely, example 7, including 50 wt. % alkyd, maintains an adhesion rating less than or equal to about 2 for at least 300 hours after lamination. Example 6, including 35 wt. % alkyd, maintains an adhesion rating less than about 3 for at least 300 hours. Examples 3, 4 and 5, including 20, 25, and 30 wt. % alkyds, respectively, maintain an adhesive rating less than or equal to about 3 for at least 300 hours. Example 2 including 15 wt.% alkyd maintains an adhesion less than or equal to about 3 for at least 5 hours. As shown in Figure 2, the adhesion rating for Example 2 returns to an acceptable adhesion rating of about 3 after approximately 100 hours.

[0079] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and

variations of this invention provided they come within the scope of the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A cold foil adhesive composition comprising:
an alkyd in an amount greater than or equal to about 15 wt. %; and
a solvent.

2. The adhesive according to claim 1, further comprising a resin selected from the group consisting of modified rosin resins, petroleum hydrocarbon resins, ketone resins, urea resins, urea formaldehyde resins, and combinations thereof.

3. The adhesive composition according to claim 2, wherein said modified rosin resins are selected from the group consisting of modified phenolic rosin resins, modified maleic rosin resins, modified fumaric rosin resins, and combinations thereof.

4. The adhesive composition according to claim 1, wherein the amount of alkyd is greater than or equal to about 20 wt. %.

5. The adhesive composition according to claim 4, wherein the amount of alkyd is greater than or equal to about 30 wt. %.

6. The adhesive composition according to claim 1, wherein the alkyd is selected from the group consisting of a coconut oil reaction product; a rapeseed oil reaction product; a polyester modified with hydrogenated ricinolic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, stearic acid, arachidic acid, behenic acid, lingnoceric acid, cerotic acid or montanic acid; and combinations thereof.

7. The adhesive composition according to claim 1, wherein the alkyd is formed by a reaction product including an oil selected from the group consisting of tall oil, soya bean oil, sunflower oil, rapeseed oil, corn oil, tung oil, linseed oil, oiticica oil, palm oil, peanut oil, cotton oil, castor oil, jatropa oil, olive oil, grape oil, sesame oil, fish oil, safflower oil, perilla oil, tallow oil, and combinations thereof.

8. The adhesive composition according to claim 1, wherein the solvent is selected from the group consisting of medium chain triglycerides, propylene glycol esters of fatty acids, esters of trimellitic acids, fatty acid esters of pentaerithritol, esters of acetylated citric acids, mineral oils, vegetable oils, ethers, and combinations thereof.

9. The adhesive composition according to claim 7, further comprising a metal drier.

10. The adhesive composition according to any of the preceding claims, further comprising:

a photoinitiator, and

an oligomer selected from the group consisting of an epoxy acrylate, an epoxy methacrylate, a polyether acrylate, a polyether methacrylate, a polyester acrylate, a polyester methacrylate, a polyurethane acrylate, a polyurethane methacrylate, a melamine acrylate, a melamine methacrylate, and combinations thereof.

11. A cold foil laminate package comprising:
a primary or secondary packaging substrate;
a cold foil adhesive according to claim 1 printed on a surface of the substrate; and
a metal foil laminated onto the adhesive.

12. The package according to claim 11, wherein the cold foil adhesive is food-safe or low migration.

13. A method of manufacturing a cold foil laminate including:
providing a substrate;
applying an adhesive according to claim 1 onto a surface of the substrate, and
laminating a metal foil onto the adhesive.

14. The method according to claim 13, wherein the adhesive is food-safe or low migration.

15. The method according to claim 13, wherein an adhesion rating less than or equal to about 3 is maintained for at least 5 hours after lamination.

16. The method according to claim 15, wherein the adhesion rating less than or equal to about 3 is maintained for at least 100 hours after lamination.

17. An ink formulation including the adhesive according to any of the preceding claims.

18. The adhesive according to any of the preceding claims used in food safe or low migration packaging applications.

19. The adhesive according to any of the preceding claims used in offset printing applications.

20. The adhesive according to any of the preceding claims used in pharmaceutical packaging applications.

21. The adhesive according to any of the preceding claims used in cosmetic packaging applications.

22. A cold foil adhesive lamination system which maintains acceptable adhesion directly after cold foil lamination through market implementation.

23. Cold foil adhesive laminated packages capable of exportation to a customer in less than one week.

24. The packages according to claim 23 capable of exportation to said customer in less than 24 hours.

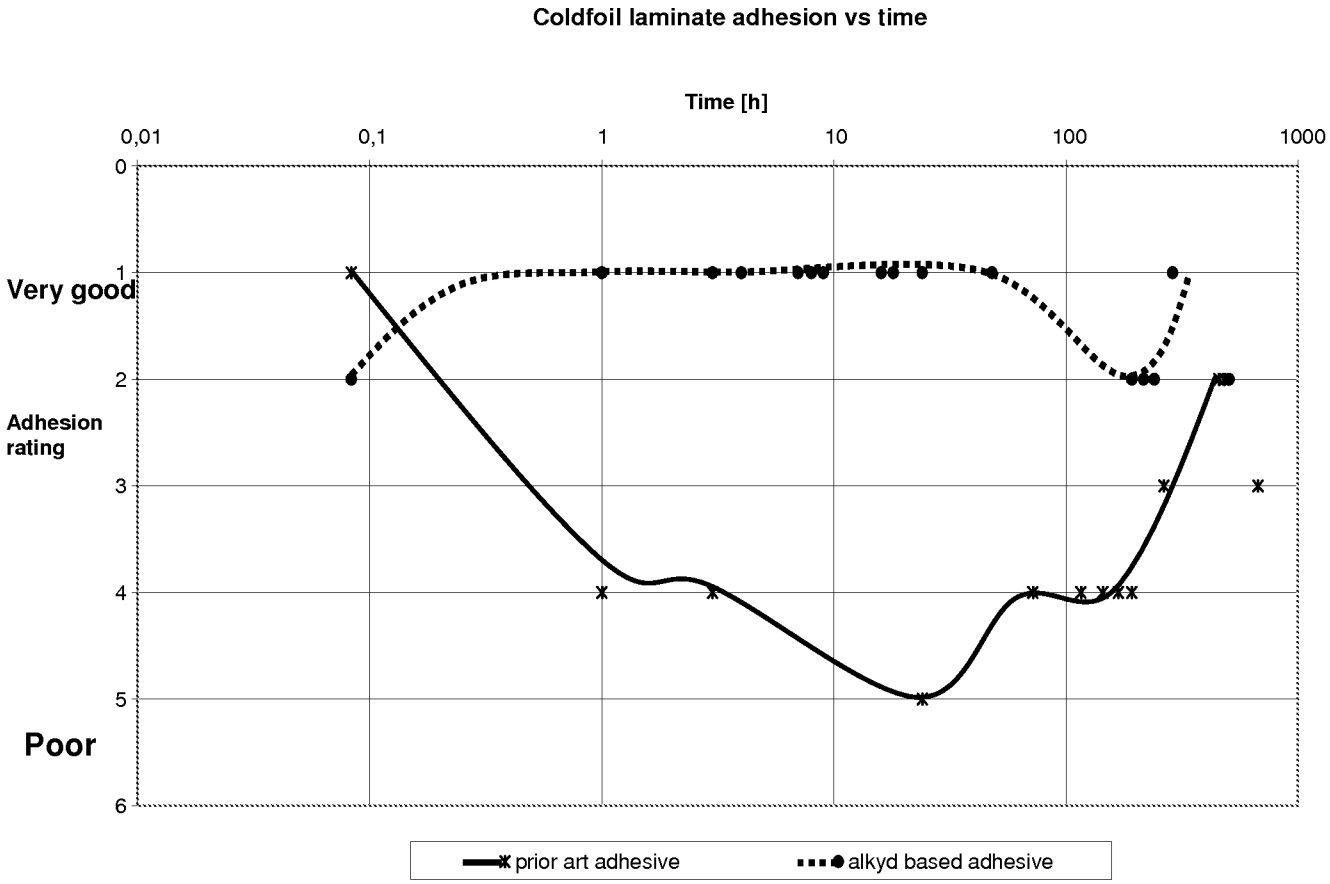
Coldfoil laminate adhesion vs time
Time [h]
0,01
0,1
1
10
100
1000
0
1
2
3
4
5
6
Very good
Adhesion rating
Poor
prior art adhesive
alkyd based adhesive

FIGURE 1

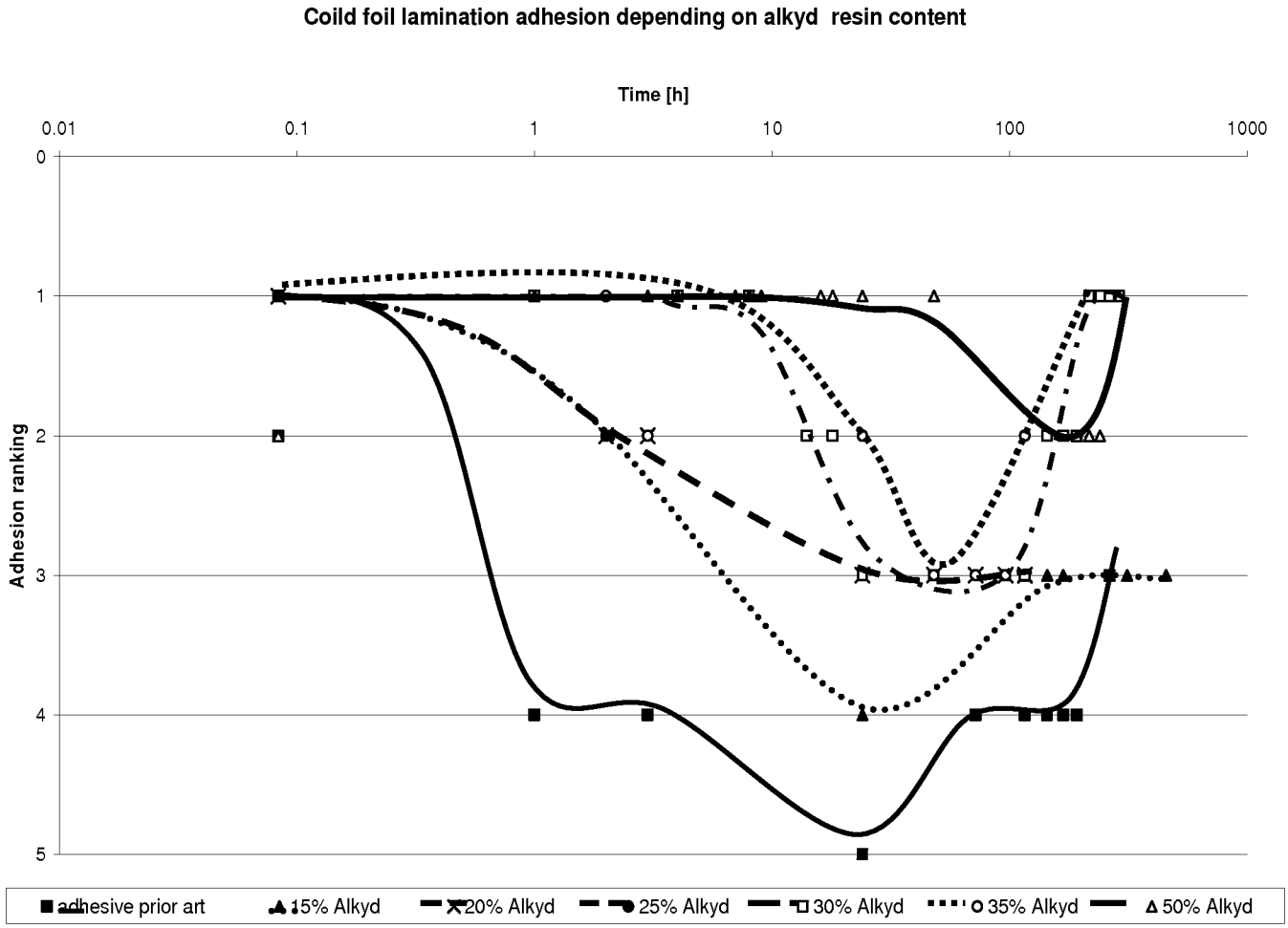
Coild foil lamination adhesion depending on alkyd resin content
Time [h]
0.01
0.1
1
10
100
1000
Adhesion ranking
0
1
2
3
4
5
adhesive prior art
15% Alkyd
20% Alkyd
25% Alkyd
30% Alkyd
35% Alkyd
50% Alkyd

FIGURE 2