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(54) Title: ELASTOMERIC PRESSURE-SENSITIVE ADHESIVE COMPOSITIONS EXHIBITING GOOD CUTTING PERFORMANCE

(57) **Abrégé/Abstract:**

The cuttability of elastomeric pressure-sensitive adhesives, particularly of hot-melt tackified mutually immiscible elastomers, is improved by the addition of surfactants containing polyethylene-oxide and polypropylene-oxide blocks.





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(21) International Application Number: PCT/US92/10549 (22) International Filing Date: 4 December 1992 (04.12.92) (30) Priority data: 802,881 6 December 1991 (06.12.91) US (71) Applicant: AVERY DENNISON CORPORATION [US/ US]; 150 N. Orange Grove Boulevard, Pasadena, CA 91109 (US). (72) Inventors: SASAKI, YUKIHIKO ; 170 Armstrong Drive, Claremont, CA 91711 (US). ERCILLO, Jesse, Concep- cion ; 16330 Benbow Street, Covina, CA 91722 (US). (74) Agent: GRINNELL, John, P.; Christie, Parker & Hale, P.O. Box 7068, Pasadena, CA 91109-7068 (US).		(81) Designated States: AU, CA, FI, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: ELASTOMERIC PRESSURE-SENSITIVE ADHESIVE COMPOSITIONS EXHIBITING GOOD CUTTING PERFORMANCE (57) Abstract The cuttability of elastomeric pressure-sensitive adhesives, particularly of hot-melt tackified mutually immiscible elastomers, is improved by the addition of surfactants containing polyethylene-oxide and polypropylene-oxide blocks.		

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**ELASTOMERIC PRESSURE-SENSITIVE ADHESIVE COMPOSITIONS
EXHIBITING GOOD CUTTING PERFORMANCE**

Field of the Invention

The present invention is directed to elastomeric rubber based pressure-sensitive adhesive compositions used in label and tape manufacture where the adhesive employed has improved cuttability and therefore convertability.

Background of the Invention

During the process of converting pressure-sensitive bulk products such as rolls of a laminate of a face stock or backing, a pressure-sensitive adhesive layer, and a release liner into end products, many cutting operations are performed. These include slitting, sheeting, guillotining including hole punching and perforating, and die cutting on rotary and flat-bed machines.

Die cutting for label manufacture is the most complex. There, a laminate of a face stock or backing, pressure-sensitive adhesive layer and a release liner is passed through apparatus which converts the laminate to yield commercially useful labels from label stock.

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1 The processes involved in converting operations include
printing, die cutting and matrix stripping to leave
labels on a release liner, butt cutting of labels to
the release liner, marginal hole punching, perforating,
5 fan folding, guillotining and the like.

Die and butt cutting involve cutting of the
laminate to the face of the release liner. Other
procedures involve cutting clean through the label
laminate and include hole punching, perforating and
10 guillotining.

The cost of converting a laminate into a finished
product is a function of the speed at which the various
processing operations occur. While the nature of all
layers of the laminate can impact cost of
15 convertability, the adhesive layer has been the
greatest limiting factor in ease and cost of
convertability. This is in consequence of its
viscoelastic nature which hampers precise and clean
penetration of a die in die cutting operations and
20 promotes adherence of the adhesive to cutting blades
and the like in converting operations.

For slitting and sheeting, the cutting blade,
because of adhesive adherence, becomes tacky and forms
so called "gum balls." The gum balls transfer to the
25 surface of paper and produce product defects. Quite
often, the operators have to stop the cutting operation
and clean the blade. Placing a lubricant such as
mineral oil on the surface of the blade can help the
cutting process.

30 For die cutting, poor cutting causes matrix breaks
when waste matrix is peeled off. In order to avoid the
matrix breaks, the press operators are forced to lower
the converting speed.

For guillotining where stacks of sheets are cut at
35 the same time, the cutting edge of the paper tends to
become tacky. As a result the separation of each sheet

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1 becomes difficult and subsequent printing process may
be jammed.

5 In order to improve the converting process,
minimization of adhesive adherence to cutting blades is
most important.

U.S. Patents 4,151,319 to Sackoff et. al and
4,346,189 to Laurent claim addition of silicone oil and
gums to adhesive compositions. These additives improve
cutting performance, but at a sacrifice in adhesion.

10 While not directly related to cutting performance,
U.S. Patent 4,693,935 to Mazurek discloses
polysiloxane-grafted adhesive copolymers. The adhesive
compositions claimed are repositionable with adhesive-
bonding building upon dwell for an extended time.

15 U.S. Patent 4,548,845 to Parsons et. al teaches
the addition of a polyoxyalkylene polyol such as
polyethylene glycol to tackified water-insoluble
adhesives to reduce the adhesive build-up on a knife
blade during guillotine cutting. This has resulted in
20 phase separation and incompatibility in some adhesive
systems.

Summary of the Invention

25 According to the invention, cutting performance of
pressure-sensitive adhesive compositions is improved by
the addition of block copolymers with hydrophilic and
hydrophobic blocks with the following structures being
preferred:

- 30 PEO-PPO-PEO (1)
PPO-PEO-PPO (2)
(PEO-PPO-)₄ (3)
(PPO-PEO-)₄ (4)

where PEO is a hydrophilic polyethylene-oxide block and
35 PPO is a hydrophobic polypropylene-oxide block. The
inclusion of a compatible wax in an amount up to 15% by
weight of the total composition and can be effective to

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1 improve guillotinability or cuttability. The presently
preferred wax is a polyethylene glycol wax,
specifically Carbowax™ 1450.

5 The surfactants may be employed in a concentration
of from about 1% to about 15% by weight of the resin,
and preferably have an HLB (hydrophilic-lipophilic
balance) value in excess of 7, preferably from 12 to
greater than 24. To our surprise, addition of these
10 surfactants to hot melt compositions not only improves
cutting performance of adhesive laminates, but also
three major advantages over the prior art were found.

When polyethylene glycol and polysiloxanes are
added to adhesive composition, adhesive performance
goes down considerably, especially peel adhesion and
15 tack. Addition of surfactants lower the adhesive
performance to a significant lesser extent.

Moreover, polysiloxanes and polyethylene glycol
are both incompatible with rubber-based adhesives.
Although they can be used when solvent coating is
20 employed, in hot-melt compositions incompatibility of
these materials caused a problem due to phase
separation.

Due to the hydrophobic nature of the
polypropylene-oxide block, these surfactants are
25 compatible with rubber-based adhesives and are easy to
handle; phase separation is not a problem. These
surfactants can therefore be utilized for water-based
as well as solvent-based adhesives in addition to use
in hot melt adhesives.

30 The pressure-sensitive adhesive is preferably
coated onto a silicone-coated release paper, and any
additive added to the pressure-sensitive adhesive (PSA)
preferably should not adversely affect the release
characteristics. When the surfactant (Pluronic*F-108)
35 was added to a hot melt formulation, release
characteristics were not affected greatly at all speed
ranges tested (up to 300 m/min). (See Table 2 below

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1 for description of Pluronic F-108.) When polyethylene-
glycol is added to a similar adhesive composition, high
speed release became adversely affected and became
harder to release. One of the converting process
5 includes label making process where rotary die cutting
and matrix stripping is quite often the rate
determining process. The matrix stripping requires
good release characteristics over a wide range of
speeds and is especially important at high speeds. If
10 the release is too tight the matrix breaks and
converting speed suffers. Even if cutting performance
is improved, this may not overcome matrix stripping
difficulties. When conversion was tested on a high-
speed Mark Andy Press compositions containing
15 polyethylene glycol showed convertability worse than
adhesive without additives, while Pluronic F-108
addition increased converting speed markedly.

The elastomeric or rubber-based pressure-sensitive
adhesive is preferably based on a combination of two or
20 more immiscible elastomers which, when combined in
proper proportion, provide at least two glass
transition temperatures, and by the addition of one or
more tackifiers. Addition of one or more of the
tackifiers produces an increase in the difference
25 between the two glass transition temperatures as a
consequence of preferential miscibility of the
tackifier in the elastomer having the highest glass
transition temperature and an amplification of tangent
delta of the elastomer having the higher glass
30 transition temperature. Although explained in terms of
diene elastomers, the invention is contemplated to be
applicable to immiscible tackifiable and internally
tackified polymers including, but not limited to,
acrylic ester based polymers and the like.

35 The surfactant additive may have utility with
rubber-based and acrylic-based adhesives having a
single glass transition temperature.

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1 In a preferred aspect, the invention is based on
an admixture of a first elastomer providing a first
polymerized diene, preferably polybutadiene, and
exhibiting a first glass transition temperature and a
5 second natural or synthetic elastomer providing a
second polymerized diene component, preferably
polyisoprene, and having a second glass transition
temperature higher than the first. The elastomers are
mixed in proportion to exhibit a dynamic mechanical
10 spectrum (DMS), i.e., a plot of a tangent delta (the
ratio of G'' to G' as defined herein) against
temperature, with at least two, as opposed to one,
distinct peaks corresponding to glass transition
temperatures of the first polymerized diene
15 (polybutadiene) and second polymerized diene
(polyisoprene) components of the immiscible blend. A
tackifying system comprising at least one solid
tackifier is added to increase the glass transition
temperature of at least the second peak in order to
20 increase the temperature differential between the
peaks, while increasing the amplitude (tangent delta)
of the second (polyisoprene) peak. Shifting at least
the second peak toward ambient temperature improves
ambient temperature pressure-sensitive adhesive
25 performance. The maintenance of the first peak assures
low temperature pressure-sensitive adhesive
performance. Low values of tangent delta give good
processability and cuttability.

30 The immiscible rubbers are provided in proportion
of the polybutadiene containing elastomer to the
polyisoprene containing elastomer from about 0.5:1 to
about 5:1 and comprise from about 20% to about 50% by
weight of the total weight of the mixture of elastomers
and tackifying additive.

35 The tackifying system is preferentially soluble in
the polyisoprene component and comprises a normally
solid tackifying resin, preferably based on polymerized

1 structures derived from aliphatic dienes and mono-
olefins containing 5 or 6 carbon atoms, preferably with
at least 40% of the structures derived from piperylene
or from piperylene and isoprene, aromatic resins which
5 are hydrogenated to the degree that substantially all
of the benzene rings are converted to cyclohexane
rings, and hydrogenated polycyclic resins such as
hydrogenated dicyclopentadiene resins. The additive
system preferably includes a normally liquid tackifying
10 resin which is preferentially soluble in the
polyisoprene component. Other constituents of the
tackifying system may include rosin, rosin ester and
polyterpenes which are at least partially compatible
with the polyisoprene component, and plasticizing oils.
15 The additives do not, however, limit the function of
the tackifiers, namely, increasing the glass transition
temperature differential between the peaks.

Presently preferred compositions are those in
which the ratio of the polybutadiene-based elastomer to
20 the polyisoprene-based elastomer is about 1.3:1 and
present in about 15% to about 30% by weight based on
the total composition, the balance of the composition,
except for inhibitors, antioxidants and other
modifiers, are tackifiers.

25 The invention is also useful in improving cutting
performance of natural rubber (polyisoprene) based
adhesives as well as styrene-isoprene and styrene
butadiene di and triblock copolymers.

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The present invention provides a pressure-sensitive adhesive composition exhibiting improved cuttability, for use in a pressure-sensitive label construction, said composition comprising a mixture of a hot-melt, elastomeric pressure-sensitive adhesive comprising a combination of at least two mutually immiscible elastomers which, when combined, provide at least two glass transition temperatures, and a tackifying system comprising at least one tackifier that is more soluble in the elastomer of highest glass transition temperature than it is in the other elastomer(s); and an effective amount of a surfactant comprised of hydrophillic polyethylene oxide blocks and hydrophobic polypropylene oxide blocks, said surfactant having a hydrophillic-lipophilic balance (HLB) value greater than 7; and 0 to 15% by weight of the mixture of a compatible wax.

In a further aspect, the present invention provides a method of producing pressure-sensitive adhesive composition exhibiting improved cuttability, for use in a pressure-sensitive label construction, said method comprising mixing a mixture of a hot-melt, elastomeric pressure-sensitive adhesive comprising a combination of at least two mutually immiscible elastomers which, when combined, provide at least two glass transition temperatures, and a tackifying system comprising at least one tackifier that is more soluble in the elastomer of highest glass transition temperature than it is in the other elastomer(s); and an effective amount of a surfactant comprised of hydrophillic polytheylene oxide blocks and hydrophobic polypropylene oxide blocks, said surfactant having a hydrophillic-lipophilic balance

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(HLB) value greater than 7; and 0 to 15% by weight of the mixture of a compatible wax.

5 The present invention also provides a pressure-sensitive adhesive exhibiting improved cuttability of a pressure-sensitive label construction which comprises an elastomeric hot melt pressure-sensitive adhesive containing from about 1 to about 15%, by weight, based on the weight of surfactant and elastomer pressure-sensitive adhesive of a surfactant comprised of hydrophilic polyethylene-oxide blocks and hydrophobic polypropylene-oxide blocks, and having an HLB value greater than 7 and from 0 to about 15% by weight of the composition of a compatible wax said elastomeric portion of the elastomeric pressure-sensitive adhesive comprising of a first elastomer selected from the group consisting of a styrene-butadiene block copolymer, a styrene-butadiene-styrene block copolymer and mixtures thereof, said first elastomer exhibiting a first glass transition temperature and a first value of tangent delta measured as a function of temperature; a second elastomer selected from the group consisting of styrene-isoprene-styrene block copolymers, styrene-isoprene block copolymers, multi-armed styrene-isoprene block copolymers and mixtures thereof, said second elastomer exhibiting a second glass transition temperature greater than the first glass transition temperature and a second value of tangent delta measured as function of temperature, the second elastomer being immiscible in the first elastomer, said first and second elastomers provided in proportions of 0.5:1 to 5:1 and in which a DMS plot of tangent delta as a function of temperature exhibits a polybutadiene-

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attributable first glass transition temperature peak
determinable separate from and lower than polyisoprene-
attributable second glass transition temperature peak;
and a tackifying system comprising a normally solid
5 tackifying component having a softening point of about
95°C and obtained by polymerization of a stream solely
composed of aliphatic petroleum derivatives in the form
of dienes and monoolefins containing 5 or 6 carbon atoms,
said tackifying component being preferentially miscible
10 with the polyisoprene blocks of the second elastomer and
present in an amount of from about 50% to about 80% by
weight of the elastomers and tackifying system and
sufficient to cause an increase in the second glass
transition temperature and an increase in the temperature
15 difference between the polybutadiene-attributable glass
transition temperature peak and the polyisoprene-
attributable glass transition temperature peak and an
increase in the tangent delta value attributed to the
polyisoprene-attributable peak.

20 The present invention also provides a pressure-
sensitive adhesive exhibiting improved cuttability as an
element of a pressure-sensitive label construction which
pressure-sensitive adhesive comprises an elastomeric hot
melt pressure-sensitive adhesive formed of a first
25 elastomer providing a first polymerized diene component
exhibiting a first glass transition temperature and a
second elastomer providing a second polymerized diene
component exhibiting a second glass transition
temperature greater than the first glass transition
30 temperature, and a tackifying additive comprising at
least one tackifier that is more soluble in the second

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5 elastomer than it is in the first elastomer and present
in an amount sufficient to cause the dynamic mechanical
spectrum of the mixture of immiscible elastomers to
exhibit an increase in the second glass transition
temperature and an increase in the difference between the
first and second glass transition temperatures and an
increase in the value of tangent delta determined at the
second glass transition temperature, and in which the
elastomers are present in an amount of from about 20 to
10 50% by weight of elastomers and tackifying additive, said
pressure sensitive adhesive containing a surfactant
having an HLB value greater than 7 comprised of at least
one hydrophilic polyethylene oxide block and at least one
hydrophobic propylene oxide block and from 0 to about
15 15% by weight of the composition of a compatible wax.

The present invention also provides a pressure-
sensitive adhesive exhibiting improved cuttability as an
element of a pressure-sensitive label construction which
pressure-sensitive adhesive comprises an elastomeric hot
20 melt pressure-sensitive adhesive formed of a first
elastomer providing a first polymerized diene component
which is a polybutadiene, said first elastomer exhibiting
a first glass transition temperature and a second
elastomer providing a second polymerized diene which is a
polyisoprene, said second elastomer component exhibiting
25 a second glass transition temperature greater than the
first glass transition temperature, and a tackifying
additive comprising at least one tackifier that is
soluble in the second elastomer than it is in the first
30 elastomer and present in an amount sufficient to cause
the dynamic mechanical spectrum of the mixture of

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immiscible elastomers to exhibit an increase in the second glass transition temperature and an increase in the difference between the first and second glass transition temperatures and an increase in the value of tangent delta determined at the second glass transition temperature, and in which the elastomers are present in an amount of from about 20 to 50% by weight of elastomers and tackifying additive, said pressure sensitive adhesive containing a surfactant having an HLB value greater than 7 and comprised of at least one hydrophilic polyethylene oxide block and at least one hydrophobic propylene oxide block and from 0 to about 15% by weight of the composition of a compatible wax.

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1 The Drawings

FIGS. 1 to 7 are block diagrams illustrating 90° peel in pounds per inch to various substrates of the composition identified in Table 8 and are based on the date reported in Tables 9 and 10. The face stocks or backing were satin litho, high gloss paper and primed high gloss paper. In the FIGURE, "p" means panel failure, "ps" means panel stain and "F" means face stock failure.

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1 Detailed Description

 The present invention is directed to improving the
cuttability of elastomeric pressure-sensitive
adhesives, especially adhesives based on polymers of
5 butadiene and isoprene, preferably mixtures of two
immiscible natural or synthetic elastomers, one based
on a first polydiene, preferably polybutadiene or one
containing polybutadiene blocks, exhibiting a first
10 glass transition temperature and a value of tangent
delta and the other based on a second polydiene,
preferably polyisoprene or one containing polyisoprene
blocks exhibiting a second glass transition temperature
higher than the first and a second value of tangent
15 delta associated therewith. The two elastomers are
combined in proportion whereby there is exhibited two
distinct glass transition temperature peaks in a DMS
curve, a plot of tangent delta as a function of
temperature in °C. There is provided to the
20 composition a tackifying system which comprises
tackifiers preferentially soluble in the second
polydiene component which cause the temperature
differential between the glass transition temperature
peaks in the DMS curve to increase and the amplitude of
the tangent delta for the second glass transition
25 temperature to also increase. The net result is to
provide a pressure-sensitive adhesive composition
exhibiting improved conversion as seen in ability to
cut the adhesive and excellent low and ambient
temperature pressure-sensitive adhesive performance.
30 The performance of the adhesive is improved even more
by additives which also benefit cuttability of
tackified styrene-butadiene-styrene, styrene-butadiene,
styrene-isoprene-styrene, styrene-isoprene and like
copolymers as well as natural rubbers (polyisoprene)
35 and other related elastomer polymers. The additives
may be used in solvent, emulsion and hot-melt
adhesives. Hot melt adhesives are especially

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1 benefitted. The preferred adhesives systems are
described in detail in U.S. Patent No. 5,290,842
issued March 1, 1994.

5 As used for such adhesive, "tackifier system"
consists of tackifiers include normally liquid and
solid tackifiers which leave unchanged the glass
transition temperature of the elastomeric block in
which they are not soluble. There may also be employed
10 plasticizer oils which lower the glass transition
temperature. Tackifier systems used in the practice of
the instant invention, include conventional tackifiers
and plasticizer oils, and for the preferred blends of
incompatible elastomers have the net effect of being
15 preferentially soluble in the polyisoprene block so as
to preferentially increase the difference between the
glass transition temperature of the polyisoprene block
component relative to the polybutadiene block
component, with an increase (amplification) of the
20 tangent delta of the polyisoprene peaks of the
pressure-sensitive adhesive composition.

More particularly, polymers used in formulating
the pressure-sensitive adhesives of this invention are
based on natural and/or synthetic elastomeric polymers.
25 Useful are AB, ABA and (AB)_x block copolymers wherein x
has a value of 3 or more and wherein A is a block
comprising at least one monoalkenyl arene, preferably
styrene, alpha methyl styrene, vinyl toluene and the
like, and B is an elastomeric conjugated diene block,
30 preferably a polybutadiene or a polyisoprene block.
Preferably at least one is based on polybutadiene
blocks and one other is based on polyisoprene blocks.
These include, but are not limited to, homopolymers,
block, random or multiarmed copolymers, and mixtures
35 thereof. Among the useful elastomeric polymers there
may be mentioned natural rubber (polyisoprene),
polybutadiene, synthetic polyisoprene, random styrene-

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1 butadiene polymers, styrene-butadiene (SB) block
copolymers, multiarmed and repeating (SB) copolymers,
styrene-butadiene-styrene (SBS) block copolymers,
styrene-isoprene (SI) block copolymers, styrene-
5 isoprene-styrene (SIS) block copolymers, multiarmed
styrene-isoprene (SI)_x block copolymers, and the like.
It will be understood that random copolymers may also
be used and can reverse the diene preferentially
tackified so long as the glass transition temperature
10 of the polymer exhibiting the highest glass transition
temperature is increased relative to the polymer of
lower glass transition temperature.

Commercial elastomeric polymers used include
linear SIS/SI block copolymers known as Kraton* D-1107
15 and D-1112, SBS/SB block copolymers known as Kraton D-
1101, D-1102 and DX-1300, and an (SI)_x block copolymer
known as Kraton D-1320X, all manufactured and sold by
Shell Chemical Company, and an SB block copolymer known
as Solprene* 1205 manufactured and sold by Housemex,
20 Inc. As indicated, in many of the SIS or SBS block
copolymers, there are respectively present SI or SB
components.

Other elastomers, such as the ethylene-propylene
diene rubbers, styrene-ethylene/butylene, styrene block
25 copolymers, styrene-ethylene/propylene-styrene block
copolymers and the like, may also be used.

The weight ratio of the polybutadiene containing
constituents of the mixture to the polyisoprene
constituents of the mixture are such that there are
30 provided two peaks on the DMS curve for the mixture.
Generally, weight ratios range from about 0.5:1 upward.
Compositions contemplated to be used in accordance with
the instant invention are combined in ratio of about
0.5:1 to about 5:1, preferably from about 1:1 to about
35 1.5:1, and most preferably from about 1.3:1.

Tackifier additives for the polyisoprene component
are preferably obtained by the polymerization of a

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1 stream of aliphatic petroleum derivatives in the form
of dienes and mono-olefins containing 5 or 6 carbon
atoms generally in accordance with the teachings of
U.S. Patent Nos. 3,577,398 to Pace and 3,692,756 to St.
5 Cyr. The
resultant hydrocarbons range from materials which are
normally liquid at room temperature to those which are
normally solid at room temperature and typically
contain 40% or more by weight polymerized dienes. The
10 dienes are typically piperylene and/or isoprene. They
are sold by the Chemical Division of Goodyear Tire and
Rubber Company as the Wingtack family of resins with
the numerical designation being the softening point,
e.g., Wingtack* 95 which is normally a solid resin
15 having a softening point of about 95°C and Wingtack 10
which is normally a liquid resin having a softening
point of about 10°C.

Other normally solid tackifiers are Escorez* 1310
LC manufactured by Exxon and Piccotac* 95 manufactured
20 by Hercules.

Other additives which may serve a tackifier
function include hydrogenated aromatic resins wherein
a very substantial portion, if not all, of the benzene
rings are converted to cyclohexane rings (for example,
25 the Regalrez family of resins manufactured by Hercules
such as Regalrez* 1018, 1033, 1065, 1078 and 1126, and
Regalite* R-100, and the Arkon family of resins from
Arakwa Chemical such as Arkon* P-85, P-100, P-115 and
P-125), hydrogenated polycyclic resins (typically
30 dicyclopentadiene resins such as Escorez 5300, 5320,
5340 and 5380 manufactured by Exxon) and the like.

There can be also added rosins, rosin esters,
polyterpenes and other tackifiers which are compatible
to some degree with the polyisoprene and polybutadiene
35 phases. Other additives include plasticizer oils such
as Shellflex* 371 manufactured by Shell and Kaydol

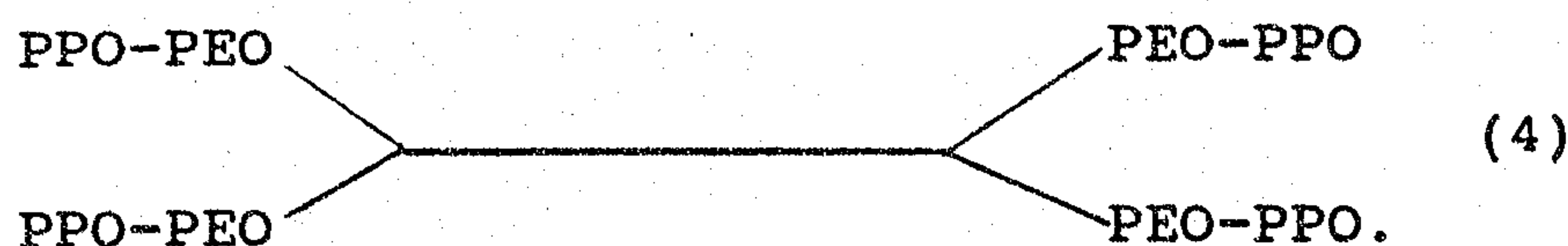
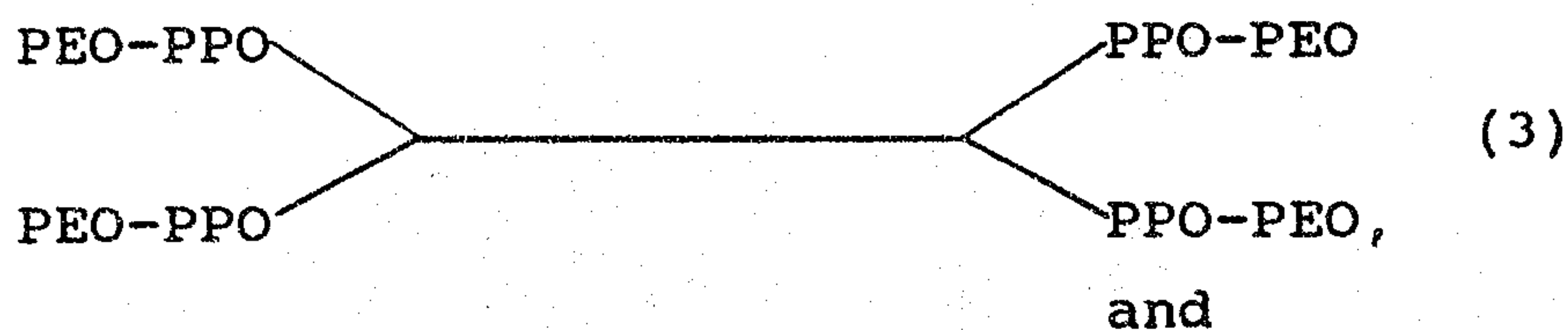
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1 mineral oil manufactured by Witco which are soluble in
both the polyisoprene and polybutadiene phases.

5 The tackifier system may be present in an amount,
based on the total weight of tackifier system and
elastomers, of from about 50% to about 80% by weight,
preferably from about 50% to about 70% by weight, more
preferably from about 60% to about 70% by weight. The
10 presently preferred ratio is about 38% by weight
elastomer and about 62% by weight tackifying resin
additive, the resin additive preferably being a mixture
of a normally solid tackifier such as Wingtack 95 or
Escorez 1310 LC and a normally liquid tackifier such as
Wingtack 10 or a plasticizer oil such as Shellflex 371.
15 Polystyrene reinforcing additives may be present but
are not required.

The surfactants employed to improve cuttability of
the above-mentioned adhesive systems are block
copolymer surfactants preferably having hydrophilic
polyethylene-oxide (PEO) blocks and hydrophobic
20 polypropylene-oxide (PPO) blocks and are generally of
the formula:



35 Mixtures may also be used. Surfactants of formulas (1)
and (2) above are PluronicTM surfactants, and

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1 surfactants of formulas (3) and (4) above are known as
the Tetronic surfactants. Both are made by BASF. The
presently preferred surfactant is Pluronic F-108 which
has a molecular weight of 14600 and an HLB of greater
5 than 24.

The surfactant may be employed in concentration of
from about 1% to about 6% by weight of surfactant and
elastomer, preferably from about 2% to about 5% by
weight, with optimized concentration varying depending
10 on the nature of the surfactant and/or the adhesive
polymer. The HLB value should exceed 7, and preferably
at least 12, and most preferably at least 24.

The surfactant may be augmented by the addition of
0 to 15% by weight of the total composition of a wax
15 including natural waxes such as montan wax, carnauba
wax, bees wax and the like, synthetic waxes such as
polyethylene and polypropylene waxes, Fischer-Tropsch
waxes, microcrystalline waxes and the like. It is
presently preferred to employ polyethylene glycol
20 waxes, preferably Carbowax™ 1450.

While, as will be seen, the pressure-sensitive
adhesive formulations of the instant invention exhibit
excellent low temperature and ambient temperature
performance as well as convertability, it may be
25 desirable to enhance elevated temperature performance.
This may be accomplished by cross-linking techniques
such as the use of electron beam (EB) radiation or
ultraviolet (UV) radiation or chemical cross-linking or
a combination of these. If employed, it is desirable
30 that tackifying additives be substantially saturated
such that all of the energy of cure goes into cross-
linking of the elastomeric components of the adhesive.

The following adhesive composition is the
presently preferred hot melt adhesive as used to
35 evaluate various surfactants identified in the tables
to follow, and is the control when used with no
surfactant additive:

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1 Elastomer and tackifier system:

	Solprene 1205	21.2%
	Kraton 1107	16.8%
	Escorez 1310 LC	24.0%
5	Wingtack 10	38.0%

Antioxidants:

	Ethyl 330	0.7 pph
	Cyanox* LTDP	0.7 pph

10

In the following tables a blade rating lower than 3 is regarded as representing an improvement in cuttability, with 3 being the blade rating for the adhesive alone. A blade rating of 3 or greater represents cuttability that was not improved.

15

In the Following Tables:

"BCS" means block copolymer surfactant

"pph" means parts by weight per 100 parts adhesive

20 "N/m" means Newtons per meter

"RT" means room temperature

"QS" means quick stick

"PE" means polyethylene

"CB" means recycled cardboard

25 "GL" means glass

"SS" means stainless steel

"HR" means hour

"DW" means dwell

"SL" means slight

30 The following tables describe experiments which illustrate the benefits of the addition of block copolymer surfactants to pressure-sensitive adhesives:

35

*Trade-mark

Table 1
GUILLOTINE PERFORMANCE TESTING OF TETRONIC R BLOCK COPOLYMER SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C Pa.s	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	H&B	GUILLOTINE PERFORMANCE TEST		FACE STOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
CONTROL	14.6	-	-	-	3	SL CLUMPING	OK	SHORT
TETRONIC R BCS								
3 pph	19.4	18700	80	12 - 18	3.5	SL CLUMPING	OK	MEDIUM
3 pph	19.9	10200	80	12 - 18	2.8	SL CLUMPING	OK	MEDIUM
3 pph	17.4	7240	40	1 - 7	3.3	SL CLUMPING	VERY POOR	LONG
3 pph	17.9	5230	40	7 - 12	2.8	SL CLUMPING	VERY POOR	LONG
3 pph	16.6	3740	40	7 - 12	3	SL CLUMPING	VERY POOR	LONG
Adhesive on Guillotine Blade								
Description								
1 - Excellent					No adhesive on blade			
2 - Very Good					Adhesive only on the very edge of blade. None on the sides.			
3 - Good					Adhesive beginning to stick to the sides of the blade (approximately 1/8")			
4 - Fair					Adhesive beginning to stick to the sides of the blade (approximately 1/4")			
5 - Poor					Adhesive approximately 1/2" on the blade			
6 - Very Poor					Adhesive building higher and/or thicker with each cut.			

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Table 2
PERFORMANCE OF PLURONIC SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C Pa.s	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACESTOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
(0 pph) Control	14.6	.	.	.	3	SL CLUMPING	OK	SHORT
BCS ADDITIVES								
PLURONIC F-108		14600	80	>24				
3pph	12.4				3	V.SL. CLUMPING	OK	LONG
4pph	13.6				2.2	NO CLUMPING	OK	LONG
5pph	13.8				1.5	NO CLUMPING	OK	LONG
PLURONIC R 17R5		7000	80	12 - 18				
3pph	18				2	NO CLUMPING	OK	LONG
4pph	19				2.5	V.SL. CLUMPING	OK	LONG
5pph	19.5				1.5	V.SL. CLUMPING	OK	LONG
TETRONIC 908		25000	80	>24				
3pph	18.7				2.5	NO CLUMPING	OK	LONG
4pph	15.4				2.5	NO CLUMPING	OK	MEDIUM
5pph	19.2				2.3	V.SL. CLUMPING	OK	LONG
TETRONIC R 50R8		10200	80	12 - 18				
3pph	17.7				3	V.SL. CLUMPING	OK	LONG
4pph	19.4				2.7	NO CLUMPING	OK	LONG
5pph	19.8				1.5	NO CLUMPING	OK	LONG

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Table 3
GUILLOTINE PERFORMANCE TESTING OF BLOCK COPOLYMER SURFACTANTS AT 5PPH LEVELS

TEST SAMPLE	VISCOSITY @ 173°C Pa.s	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACE STOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
BCS (5pph) Telronle 908	19.3	25000	80	>24	2	NO CLUMPING	OK	SHORT
Pluronic 17R4	18.1	2650	40	7 - 12	2	NO CLUMPING	OK	MEDIUM
Pluronic F108	15.3	14600	80	>24	1	NO CLUMPING	VERY POOR	LONG

Table 4
GUILLOTINE PERFORMANCE TESTING OF TETRONIC R BLOCK COPOLYMER SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C Pa.s	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACE STOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
TETRONIC R BCS								
3 ppH 90R8	19.4	18700	80	12 - 18	3.5	SL CLUMPING	OK	MEDIUM
3 ppH 50R8	19.9	10200	80	12 - 18	2.8	SL CLUMPING	OK	MEDIUM
3 ppH 90R4	17.4	7240	40	1 - 7	3.3	SL CLUMPING	VERY POOR	LONG
3 ppH 70R4	17.9	5230	40	7 - 12	2.8	SL CLUMPING	VERY POOR	LONG
3 ppH 50R4	16.6	3740	40	7 - 12	3	SL CLUMPING	VERY POOR	LONG

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Table 5
GUILLOTINE PERFORMANCE TESTING OF PLURONIC BLOCK COPOLYMER SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C Pa.s	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACE STOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
PLURONIC BCS								
3 pph F-108	16.8	14600	80	>24	2.5	NO CLUMPING	OK	SHORT
3 pph F-88	13.6	11400	80	>24	2.8	NO CLUMPING	OK	SHORT
3 pph F-87	18	7700	70	>24	2.5	CLUMPING	POOR	LONG
3 pph P-85	19	4600	50	12 - 18	3.5	CLUMPING	VERY POOR	LONG
3 pph F-68	13	8400	80	>24	2.5	NO CLUMPING	OK	SHORT

Table 6
GUILLOTINE PERFORMANCE TESTING OF PLURONIC R BLOCK COPOLYMER SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C P _{3.5}	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACE STOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
PLURONIC R BCS								
3 ppH 25R-8	15.7	8550	80	12 - 18	2.6	NO CLUMPING	OK	LONG
3 ppH 17R-8	13.6	7000	80	12 - 18	2.2	NO CLUMPING	OK	SHORT-MEDIUM
3 ppH 10R-8	18.8	4550	80	18 - 23	3	V. V. SL CLUMPING	OK	LONG
3 ppH 25R-5	18.7	4250	50	7 - 12	3	NO CLUMPING	VERY POOR	LONG
3 ppH 10R-5	15.5	1950	50	12 - 18	2.4	V. V. SL CLUMPING	VERY POOR	LONG

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Table 7

GUILLOTINE PERFORMANCE TESTING OF TETRONIC BLOCK COPOLYMER SURFACTANTS

TEST SAMPLE	VISCOSITY @ 175°C P _{3.3}	BCS AVE MW	HYDROPHILE % POLYOXYETHYLENE	HLB	GUILLOTINE PERFORMANCE TEST		FACESTOCK ANCHORAGE	STRINGINESS/ LEGGINESS
					BLADE RATING*	STACK		
TETRONIC BCS								
3 pph 707	16.7	12200	70	>24	2.8	NO CLUMPING	OK	SHORT
3 pph 1107	19.9	15000	70	18 - 23	3	V. SL CLUMPING	OK	SHORT
3 pph 1307	17.8	18000	70	18 - 23	3	SL CLUMPING	OK	MEDIUM
3 pph 1508	18.1	30000	80	>24	3.5	CLUMPING	OK	MEDIUM
3 pph 901	15.5	4700	10	1 - 7	3.5	CLUMPING	VERY POOR	LONG
3 pph 904	16.8	6700	40	12 - 18	3	SL CLUMPING	VERY POOR	LONG
3 pph 908	18.7	25000	80	>24	3	SL CLUMPING	OK	SHORT

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Tables 8, 9 and 10:

Table 8 shows compositions based on the addition of Carbowax™ 1450 to compositions of the invention while Tables 9 and 10 report the adhesive performance of such compositions, some to a control which was a solvent-based removable adhesive based on butyl rubber which had a guillotine value of 0.1875 Composition B(2) is a repeat of Composition B.

Table 8

	Composition A	Composition B + B(2)	Composition C
	PPH	PPH	PPH
KRATON RP6403 (SIS/SI)	34	42	-
DPX 512 (100% SIS)	-	-	18
SOLPRENE 1205 (SB)	-	-	24
ECR 143 (Tackifier)	50	41	41
PLURONIC F108 (Surfactant)	11	5	12
CARBOWAX 1450 (Wax)	5	12	5
CAMEL WITE (Opacifier)	5	5	5
IRGANOX*565 (antioxidant)	0.3	0.3	0.3
IRGAFOS*168 (antioxidant)	0.6	0.6	0.6
(GUILLLOTINE)	0.1875	0.1875	0.25
BLADE SMEAR HT. (inches)		0.1875 (2)	

* Trade-mark

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Table 9

	S.S.	ABS	HDPE	Glass	Appliance Enamel
1 Day/25°C					
Composition A	1.07,p	1.63,p	0.82,p	0.82,p	0.889,p
Composition B	0.992,p	1.44,p	0.81,p	0.81,p	0.77,p
Composition (B)2	0.906,p	1.15,p1	0.69,p	0.70,p1	0.85,p
Composition C	1.005,p1	1.43,p1	0.88,p	1.12,p1	0.833,p1
Control	0.426,p	0.639,p1	0.398,p	0.528,p	0.41,p
7 Day/25°C					
Composition A	1.21,p	1.99,pt	0.842,p	0.956,p	0.90,p
Composition B	1.15,p	1.59,p1	0.86,p	0.97,p	0.88,p
Composition C	0.922,p	1.32,pt	0.59,p	0.881,p1	0.942,p
Composition D	1.097,p1	1.74,p1	0.82,p	1.033,p1	0.925,p1
Control	0.71,p	0.84,p1	0.558,p	0.846,p	0.718,p
14 Day/25°C					
Composition A	1.272,p	2.327,p2	0.915,p	0.98,p	0.97,p
Composition B	1.174,p	1.49,p1	0.86,p	0.96,p	0.95,p
Composition C	0.957,p	1.44,pt	0.68,p	1.0,p	1.10,p
Composition D	1.11,p1	1.71,pt	0.913,p	1.04,p1	0.87,p1
Control	0.85,p	0.90,p1	0.7,p	0.917,p	0.822,p

Facestock: 011-24/P-32

Coat Weight: 21 ± gsm

p1: very light shade

p2: light staining

p3: heavy staining

pt: paper tore

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Table 10

	S.S.	ABS	HDPE	Glass	Appliance Enamel
1 Day/50°C					
Composition A	1.05,p1	2.16,F	0.89,p	0.87,p1	0.93,p
Composition B	1.03,p1	2.34,F	0.933,p	0.95,p1	0.81,p1
Composition C	0.85,p1	1.69,p2	0.78,p	0.89,p1	0.65,p1
Composition D	1.13,p2	2.20,p3	0.912,p	0.91,p1	0.99,p1
Control	0.845,p1	0.89,p2	0.77,p1	0.941,p	0.81,p
14 Day/50°C					
Composition A	1.09,p1	2.049,p3	0.84,p	0.96,p1	1.101,p
Composition B	1.19,p1	1.893,F	0.904,p	1.02,p1	1.207,p1
Composition C	1.81,pt	1.625,p3	0.77,p1	1.16,p1	1.10,p2
Composition D	1.102,p2	2.27,p3	0.90,p	1.02,p1	1.06,p1
Control	0.894,p	1.01,p2	1.10,p1	0.911,p	0.791,p
28 Day/50°C					
Composition A	1.81,p3	1.125,p3	tore	2.0,p3	0.82,p3
Composition B	0.82,p3	1.55,p3	1.23,p3	1.08,p3	1.13,p3
Composition C	1.44,p3	NA	0.75,p2	1.11,p3	1.38,p3
Composition D	1.55,p3	1.73,pt	1.363,pt	1.42,p3	1.27,p3
Control	1.03,p	1.33,p2	2.14,pt	1.11,p	1.048,p

Facestock: 011-24/P-32

Coat Weight: 21 ± gsm

p1: very light shade

p2: light staining

p3: heavy staining

pt: paper tore

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A pressure-sensitive adhesive composition exhibiting
5 improved cuttability, for use in a pressure-
sensitive label construction, said composition
comprising a mixture of
 - a) a hot-melt, elastomeric pressure-sensitive
10 adhesive comprising a combination of at least
two mutually immiscible elastomers which, when
combined, provide at least two glass transition
temperatures, and a tackifying system
15 comprising at least one tackifier that is more
soluble in the elastomer of highest glass
transition temperature than it is in the other
elastomer(s); and
 - b) an effective amount of a surfactant comprised
20 of hydrophillic polyethylene oxide blocks and
hydrophobic polypropylene oxide blocks, said
surfactant having a hydrophillic-lipophilic
balance (HLB) value greater than 7;
 - c) 0 to 15% by weight of the mixture of a
25 compatible wax.
2. The pressure-sensitive adhesive composition
according to claim 1, wherein component (a)
30 comprises:

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5 i) a first elastomer that contains a polybutadiene component and exhibits a first glass transition temperature and a first tangent delta measured as a function of temperature, and

10 ii) a second elastomer that contains a polyisoprene component and exhibits a second glass transition temperature that is greater than said first glass transition temperature and a second value of tangent delta measured as a function of temperature, said first and second elastomers provided in a proportion of 0.5:1 to 5:1, whereby a DMS plot of tangent delta as a
15 function of temperature for the combination of elastomers exhibits two distinct peaks, one attributable to a polybutadiene component and the other attributable to a polyisoprene component, and

20 iii) the tackifying system comprises at least one tackifier that is more soluble in the second elastomer than it is in the first elastomer and present in sufficient quantity to cause an increase in the temperature difference between
25 said first and second glass transition temperatures and an increase in the amplitude of said second value of tangent delta.

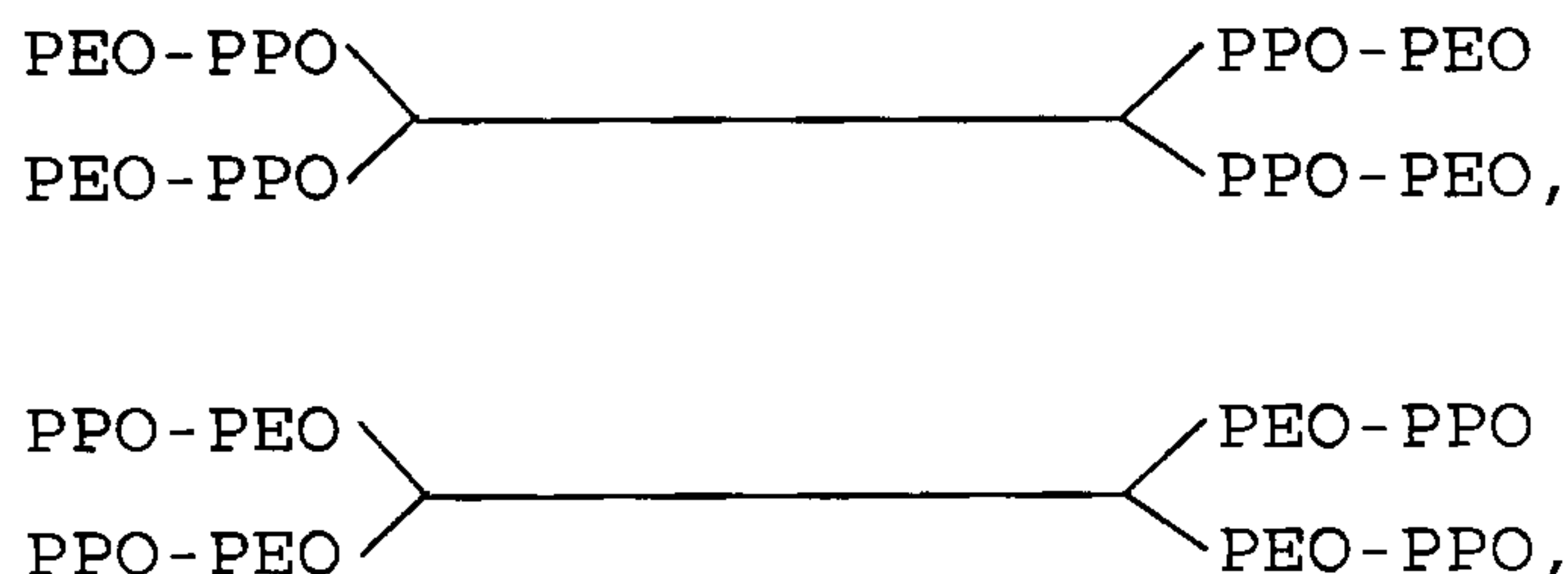
30 3. The pressure-sensitive adhesive composition according to claim 1 or claim 2, wherein the

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surfactant is selected from the group consisting of compounds of the formula:

PEO-PPO-PEO,

PPO-PEO-PPO,



5 and mixtures thereof, wherein PEO denotes a hydrophillic polyethylene oxide block, and PPO denotes a hydrophobic polypropylene oxide block.

10 4. The pressure-sensitive adhesive composition according to claim 1, wherein a first elastomer is selected from the group consisting of polybutadiene, styrene-butadiene block copolymers, styrene-butadiene-styrene block copolymers, styrene-butadiene multi-armed block copolymers, and mixtures thereof; and a second elastomer is selected from the group consisting of natural rubber, synthetic polyisoprene, styrene-isoprene block copolymers, styrene-isoprene-styrene block copolymers, styrene-isoprene multi-armed block copolymers, and mixtures thereof.

15

20

5. The pressure-sensitive adhesive composition according to any one of claims 1 to 4, wherein the

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- tackifying system is selected from the group of tackifiers consisting of polymerized C₅ or C₆ diene resins that are solid, hydrogenated aromatic hydrocarbons that are solid, saturated cycloaliphatic hydrocarbons that are solid, and mixtures thereof, alone or in combination with a polymerized C₅ or C₆ diene tackifier that is liquid, a plasticizing oil, and mixtures thereof.
- 5
- 10 6. A pressure-sensitive adhesive composition according to any one of claims 1 to 5, wherein the surfactant is present in an amount of from 1 to 15% by weight, based on the weight of the surfactant and hot-melt, elastomeric pressure-sensitive adhesive.
- 15
7. The pressure-sensitive adhesive composition according to any one of claims 1 to 5, wherein the surfactant is present in an amount of from 2 to 5% by weight, based on the weight of the surfactant and hot-melt, elastomeric pressure-sensitive adhesive.
- 20
8. The pressure-sensitive adhesive composition according to any one of claims 1 to 7, wherein the wax is a polyethylene glycol wax.
- 25
9. The pressure-sensitive adhesive composition according to any one of claims 1 to 7, wherein the combination of immiscible elastomers comprises from 20 to 50% by weight of the total weight of the elastomers and tackifying system.
- 30

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10. A pressure-sensitive adhesive composition as recited
in any one of claims 1 to 9, wherein the tackifying
system further comprises a tackifier selected from
the group consisting of rosins, rosin esters and
polyterpenes.
11. A pressure-sensitive adhesive composition as recited
in any one of claims 1 to 10, wherein the surfactant
has an HLB value of from 12 to greater than 24.
12. A pressure-sensitive adhesive label construction
having a layer of an adhesive composition as recited
in any one of claims 1 to 11 and sufficient to
improve guillotinability of the resultant label
construction.
13. A method of producing pressure-sensitive adhesive
composition exhibiting improved cuttability, for use
in a pressure-sensitive label construction, said
method comprising mixing a mixture of
- a) a hot-melt, elastomeric pressure-sensitive
adhesive comprising a combination of at least
two mutually immiscible elastomers which, when
combined, provide at least two glass transition
temperatures, and a tackifying system
comprising at least one tackifier that is more
soluble in the elastomer of highest glass
transition temperature than it is in the other
elastomer(s); and

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b) an effective amount of a surfactant comprised of hydrophillic polytheylene oxide blocks and hydrophobic polypropylene oxide blocks, said surfactant having a hydrophillic-lipophilic balance (HLB) value greater than 7;

c) 0 to 15% by weight of the mixture of a compatible wax.

14. The method according to claim 13, wherein component (a) comprises:

i) a first elastomer that contains a polybutadiene component and exhibits a first glass transition temperature and a first tangent delta measured as a function of temperature, and

ii) a second elastomer that contains a polyisoprene component and exhibits a second glass transition temperature that is greater than said first glass transition temperature and a second value of tangent delta measured as a function of temperature, said first and second elastomers provided in a proportion of 0.5:1 to 5:1, whereby a DMS plot of tangent delta as a function of temperature for the combination of elastomers exhibits two distinct peaks, one attributable to a polybutadiene component and the other attributable to a polyisoprene component, and

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iii) the tackifying system comprises at least one tackifier that is more soluble in the second elastomer than it is in the first elastomer and present in sufficient quantity to cause an increase in the temperature difference between said first and second glass transition temperatures and an increase in the amplitude of said second value of tangent delta.

15. The method according to claim 13 or claim 14, wherein the surfactant is selected from the group consisting of compounds of the formula:

PEO-PPO-PEO,

PPO-PEO-PPO,



and mixtures thereof, wherein PEO denotes a hydrophillic polyethylene oxide block, and PPO denotes a hydrophobic polypropylene oxide block.

16. The method according to any one of claim 15, wherein a first elastomer is selected from the group consisting of polybutadiene, styrene-butadiene block copolymers, styrene-butadiene-styrene block

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copolymers, styrene-butadiene multi-armed block copolymers, and mixtures thereof; and a second elastomer is selected from the group consisting of natural rubber, synthetic polyisoprene, styrene-isoprene block copolymers, styrene-isoprene-styrene block copolymers, styrene-isoprene multi-armed block copolymers, and mixtures thereof.

17. The method according to any one of claims 13 to 16, wherein the tackifying system is selected from the group of tackifiers consisting of polymerized C₅ or C₆ diene resins that are solid, hydrogenated aromatic hydrocarbons that are solid, saturated cycloaliphatic hydrocarbons that are solid, and mixtures thereof, alone or in combination with a polymerized C₅ or C₆ diene tackifier that is liquid, a plasticizing oil, and mixtures thereof.

18. A method according to any one of claims 13 to 17, wherein the surfactant is present in an amount of from 1 to 15% by weight, based on the weight of the surfactant and hot-melt, elastomeric pressure-sensitive adhesive.

19. The method according to any one of claims 13 to 17, wherein the surfactant is present in an amount of from 2 to 5% by weight, based on the weight of the surfactant and hot-melt, elastomeric pressure-sensitive adhesive.

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20. The method according to any one of claims 13 to 19,
wherein the wax is a polyethylene glycol wax.
- 5 21. The method according to any one of claims 13 to 19,
wherein the combination of immiscible elastomers
comprises from 20 to 50% by weight of the total
weight of the elastomers and tackifying system.
- 10 22. A method as recited in any one of claims 13 to 21,
wherein the tackifying system further comprises a
tackifier selected from the group consisting of
rosins, rosin esters and polyterpenes.
- 15 23. The method as recited in any one of claims 13 to 22,
wherein the surfactant has an HLB value of from 12
to greater than 24.
- 20 24. A pressure-sensitive adhesive label construction
having a layer of an adhesive composition formed in
the method of one of claims 13 to 23 and sufficient
to improve guillotinability of the resultant label
construction.
- 25 25. A pressure-sensitive adhesive exhibiting improved
cuttability of a pressure-sensitive label
construction which comprises an elastomeric hot-melt
pressure-sensitive adhesive, containing from about 1
to about 15%, by weight, based on the weight of
surfactant and elastomer pressure-sensitive
30 adhesive, of a surfactant comprised of hydrophilic
polyethylene-oxide blocks and hydrophobic

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polypropylene-oxide blocks, and having an HLB value greater than 7, and from 0 to about 15% by weight of the composition of a compatible wax, said elastomeric portion of the elastomeric pressure-sensitive adhesive comprising of:

5

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i) a first elastomer selected from the group consisting of a styrene-butadiene block copolymer, a styrene-butadiene-styrene block copolymer and mixtures thereof, said first elastomer exhibiting a first glass transition temperature and a first value of tangent delta measured as a function of temperature;

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ii) a second elastomer selected from the group consisting of styrene-isoprene-styrene block copolymers, styrene-isoprene block copolymers, multi-armed styrene-isoprene block copolymers and mixtures thereof, said second elastomer exhibiting a second glass transition temperature greater than the first glass transition temperature and a second value of tangent delta measured as function of temperature, the second elastomer being immiscible in the first elastomer, said first and second elastomers provided in proportions of 0.5:1 to 5:1 and in which a DMS plot of tangent delta as a function of temperature exhibits a polybutadiene-attributable first glass transition temperature peak determinable separate from and lower than polyisoprene-

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attributable second glass transition
temperature peak; and

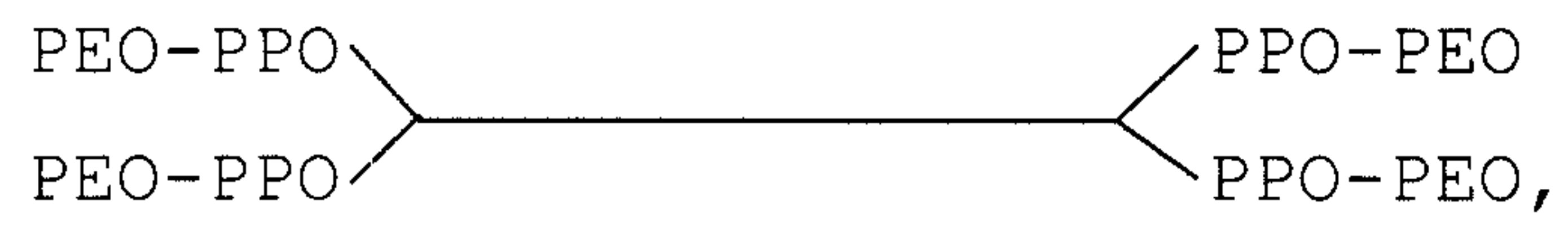
5 iii) a tackifying system comprising a normally solid
tackifying component having a softening point
of about 95°C and obtained by polymerization of
a stream solely composed of aliphatic petroleum
derivatives in the form of dienes and
10 monoolefins containing 5 or 6 carbon atoms,
said tackifying component being more miscible
with the polyisoprene blocks of the second
elastomer than it is with the polybutadiene
blocks of the first elastomer and present in an
amount of from about 50% to about 80% by weight
15 of the elastomers and tackifying system and
sufficient to cause an increase in the second
glass transition temperature and an increase in
the temperature difference between the
polybutadiene-attributable glass transition
20 temperature peak and the polyisoprene-
attributable glass transition temperature peak
and an increase in the tangent delta value
attributed to the polyisoprene-attributable
peak.

25
26. A pressure-sensitive adhesive as claimed in claim 25
in which the surfactant is selected from the group
consisting of compounds of the formula:

PEO-PPO-PEO,

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PPO-PEO-PPO,



and

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and mixtures thereof wherein PEO means a
polyethylene-oxide block and PPO means a
polypropylene-oxide block.

5

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27. A pressure-sensitive adhesive as claimed in claim 25
in which the surfactant is present in an amount of
from about 1 to about 6% by weight of the surfactant
and elastomeric pressure-sensitive adhesive.

15

28. A pressure-sensitive adhesive as claimed in claim 26
in which the surfactant is present in an amount of
from about 1 to about 6% by weight of the surfactant
and elastomeric pressure-sensitive adhesive.

20

29. A pressure-sensitive adhesive as claimed in claim 25
in which the wax is a polyethylene glycol wax.
30. A pressure-sensitive adhesive as claimed in claim 26
in which the wax is a polyethylene glycol wax.

25

31. A pressure-sensitive adhesive as claimed in claim 25
in which the weight ratio of the first elastomer to
the second elastomer is about 0.5:1 to about 1:1.

32. A pressure-sensitive adhesive as claimed in claim 25
in which the weight ratio of the first elastomer to

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the second elastomer is at about 1.0:1 to about 1.5:1.

- 5 33. A pressure-sensitive adhesive as claimed in claim 25
in which a first and second elastomer are present in
an amount of from about 30% to about 50% by weight
based on the total weight of the mixture and
tackifying system.
- 10 34. A pressure-sensitive label construction having a
layer of adhesive according to claim 25 and
sufficient to improve guillotinability of the
resultant label construction.
- 15 35. A pressure-sensitive label construction having a
layer of adhesive according to claim 26 and
sufficient to improve guillotinability of the
resultant label construction.
- 20 36. A pressure sensitive adhesive as claimed in claim 25
in which the tackifying system further comprises a
compound selected from the group consisting of a
normally liquid tackifying resins obtained by the
polymerization of a stream of aliphatic petroleum
25 derivatives in the form of dienes and monoolefins
containing 5 or 6 carbon atoms, a plasticizing oil
and mixtures thereof.
- 30 37. A pressure sensitive adhesive as claimed in claim 26
in which the tackifying system further comprises a
compound selected from the group consisting of a

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normally liquid tackifying resins obtained by the polymerization of a stream of aliphatic petroleum derivatives in the form of dienes and monoolefins containing 5 or 6 carbon atoms, a plasticizing oil and mixtures thereof.

5

38. A pressure-sensitive adhesive as claimed in claim 25 in which the weight ratio of the first elastomer to the second elastomer is about 1.3:1.

10

39. A pressure-sensitive adhesive as claimed in claim 25 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 2.5:1.

15

40. A pressure-sensitive adhesive as claimed in claim 26 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 1.5:1.

20

41. A pressure-sensitive adhesive as claimed in claim 37 in which the weight ratio of the first elastomer to the second elastomer is about 1:1 to about 1.5:1.

25

42. A pressure-sensitive adhesive as claimed in claim 38 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 1.5:1.

43. A pressure-sensitive adhesive as claimed in claim 37 in which the weight ratio of the first elastomer to the second elastomer is about 1.3:1.

30

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44. A pressure-sensitive adhesive as claimed in claim 37 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 2.5:1.
- 5 45. A pressure-sensitive adhesive as claimed in claim 38 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 2.5:1.
- 10 46. A pressure-sensitive adhesive as claimed in claim 38 in which the weight ratio of the first elastomer to the second elastomer is about 1.3:1.
- 15 47. A pressure-sensitive adhesive as claimed in claim 25 in which tackifying system further comprises a tackifier selected from the group consisting of rosins, rosin esters and polyterpenes.
- 20 48. A pressure-sensitive adhesive as claimed in claim 26 in which tackifying system further comprises a tackifier selected from the group consisting of rosins, rosin esters and polyterpenes.
- 25 49. A pressure-sensitive adhesive as claimed in claim 37 in which tackifying system further comprises a tackifier selected from the group consisting of rosins, rosin esters and polyterpenes.
- 30 50. A pressure-sensitive adhesive as claimed in claim 37 in which tackifying system further comprises a tackifier selected from the group consisting of rosins, rosin esters and polyterpenes.

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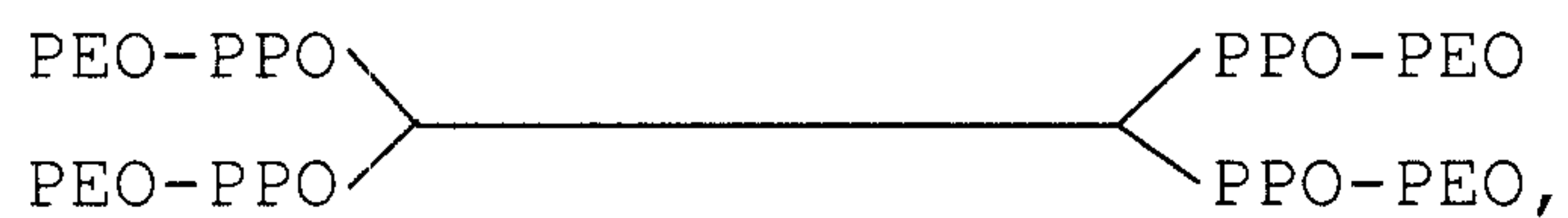
51. A pressure-sensitive adhesive exhibiting improved cuttability as an element of a pressure-sensitive label construction which pressure-sensitive adhesive comprises an elastomeric hot melt pressure-sensitive adhesive formed of a first elastomer providing a first polymerized diene component exhibiting a first glass transition temperature and a second elastomer providing a second polymerized diene component exhibiting a second glass transition temperature greater than the first glass transition temperature, and a tackifying additive comprising at least one tackifier that is more soluble in the second elastomer than it is in the first elastomer and present in an amount sufficient to cause the dynamic mechanical spectrum of the mixture of immiscible elastomers to exhibit an increase in the second glass transition temperature and an increase in the difference between the first and second glass transition temperatures and an increase in the value of tangent delta determined at the second glass transition temperature, and in which the elastomers are present in an amount of from about 20 to 50% by weight of elastomers and tackifying additive, said pressure sensitive adhesive containing a surfactant having an HLB value greater than 7 comprised of at least one hydrophilic polyethylene oxide block and at least one hydrophobic propylene oxide block and from 0 to about 15% by weight of the composition of a compatible wax.

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52. A pressure-sensitive adhesive as claimed in claim 51 in which the surfactant is selected from the group consisting of compounds of the formula:

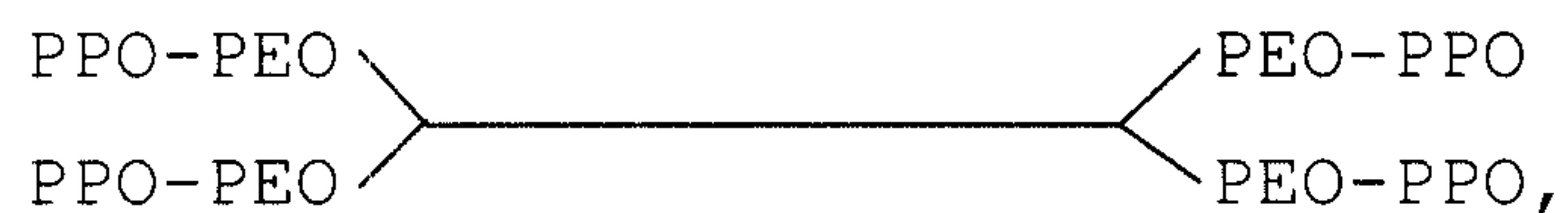
PEO-PPO-PEO,

PPO-PEO-PPO,



5

and



10 and mixtures thereof wherein PEO means a polyethylene-oxide block and PPO means a polypropylene-oxide block, said surfactant having an HLB value of at least about 7.

- 15 53. A pressure-sensitive adhesive as claimed in claim 51 in which the surfactant is present in an amount of from about 1 to about 6% by weight of the surfactant and elastomeric pressure-sensitive adhesive.

- 20 54. A pressure-sensitive adhesive as claimed in claim 52 in which the surfactant is present in an amount of from about 1 to about 6% by weight of the surfactant and elastomeric pressure-sensitive adhesive.

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55. A pressure-sensitive adhesive as claimed in claim 51 in which the wax is a polyethylene glycol wax.
56. A pressure-sensitive adhesive as claimed claim 52 in
5 which the wax is a polyethylene glycol wax.
57. A pressure-sensitive adhesive as claimed in claim 51 in which the first elastomer is selected from the group consisting of polybutadiene, styrene-butadiene
10 block copolymers, styrene-butadiene-styrene block copolymers, styrene-butadiene multi-armed block copolymers and mixtures thereof, the second elastomer is selected from the group consisting of natural rubber, synthetic polyisoprene, styrene-
15 isoprene-styrene block copolymers, styrene-isoprene block copolymers, styrene-isoprene multi-armed block copolymers and mixtures thereof, and the tackifying system is more soluble in the polyisoprene component than it is in the polybutadiene component and
20 selected from the group comprising normally solid polymerized C₅ or C₆ diene resins, normally solid hydrogenated aromatic hydrocarbons, normally solid saturated cycloaliphatic hydrocarbons and mixtures thereof, alone or in combination with a normally
25 liquid polymerized C₅ or C₆ diene tackifier, a plasticizing oil and mixtures thereof.
58. A pressure-sensitive adhesive as claimed in claim 51 in which the first elastomer is selected from the
30 group consisting of polybutadiene, styrene-butadiene block copolymers, styrene-butadiene-styrene block

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5 copolymers, styrene-butadiene multi-armed block
copolymers and mixtures thereof, the second
elastomer is selected from the group consisting of
natural rubber, synthetic polyisoprene, styrene-
isoprene-styrene block copolymers, styrene-isoprene
block copolymers, styrene-isoprene multi-armed block
copolymers and mixtures thereof, and the tackifying
system is more soluble in the polyisoprene component
than it is in the polybutadiene component and
10 selected from the group comprising normally solid
polymerized C₅ or C₆ diene resins, normally solid
hydrogenated aromatic hydrocarbons, normally solid
saturated cycloaliphatic hydrocarbons and mixtures
thereof, alone or in combination with a normally
15 liquid polymerized C₅ or C₆ diene tackifier, a
plasticizing oil and mixtures thereof.

59. A pressure-sensitive adhesive as claimed in claim 51
in which the weight ratio of the first elastomer to
20 the second elastomer is about 0.5 to about 5.

60. A pressure-sensitive adhesive as claimed in claim 51
in which the weight ratio of the first elastomer to
the second elastomer is about 0.5 to about 1.

25 61. A pressure-sensitive adhesive as claimed in claim 58
in which the weight ratio of the first elastomer to
the second elastomer is about 0.5 to about 5.

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62. A pressure-sensitive adhesive as claimed in claim 52 in which the weight ratio of the first elastomer to the second elastomer is at about 1.0 to about 1.5.
- 5 63. A pressure-sensitive adhesive as claimed in claim 59 in which the weight ratio of the first elastomer to the second elastomer is about 1.0 to about 1.5.
- 10 64. A pressure-sensitive adhesive as claimed in claim 52 in which a first and second elastomer are present in an amount of from about 30% to 50% by weight based on the total weight of the mixture and tackifying system.
- 15 65. A pressure-sensitive adhesive as claimed in claim 59 in which a first and second elastomer are present in an amount of from about 30% to 50% by weight based on the total weight of the mixture and tackifying system.
- 20 66. A pressure-sensitive adhesive as claimed in claim 52 in which the weight ratio of the first elastomer to the second elastomer is about 1.3:1.
- 25 67. A pressure-sensitive adhesive as claimed in claim 52 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 2.5:1.
- 30 68. A pressure-sensitive adhesive as claimed in claim 52 in which the weight ratio of the first elastomer to the second elastomer is about 0.5:1 to about 1.5:1.

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69. A pressure-sensitive adhesive as claimed in claim 66
in which the weight ratio of the first elastomer to
the second elastomer is about 0.5:1 to about 1.5:1.
- 5
70. A pressure-sensitive adhesive as claimed in claim 51
in which the surfactant has an HLB value of at least
12.
- 10
71. A pressure-sensitive adhesive as claimed in claim 52
in which the surfactant has an HLB value of at least
12.
- 15
72. A pressure-sensitive adhesive as claimed in claim 51
in which the surfactant has an HLB value greater
than 24.
- 20
73. A pressure-sensitive adhesive as claimed in claim 52
in which the surfactant has an HLB value greater
than 24.
- 25
74. A pressure-sensitive adhesive exhibiting improved
cuttability as an element of a pressure-sensitive
label construction which pressure-sensitive adhesive
comprises an elastomeric hot melt pressure-sensitive
adhesive formed of a first elastomer providing a
first polymerized diene component which is a
polybutadiene, said first elastomer exhibiting a
first glass transition temperature and a second
30 elastomer providing a second polymerized diene which
is a polyisoprene, said second elastomer component

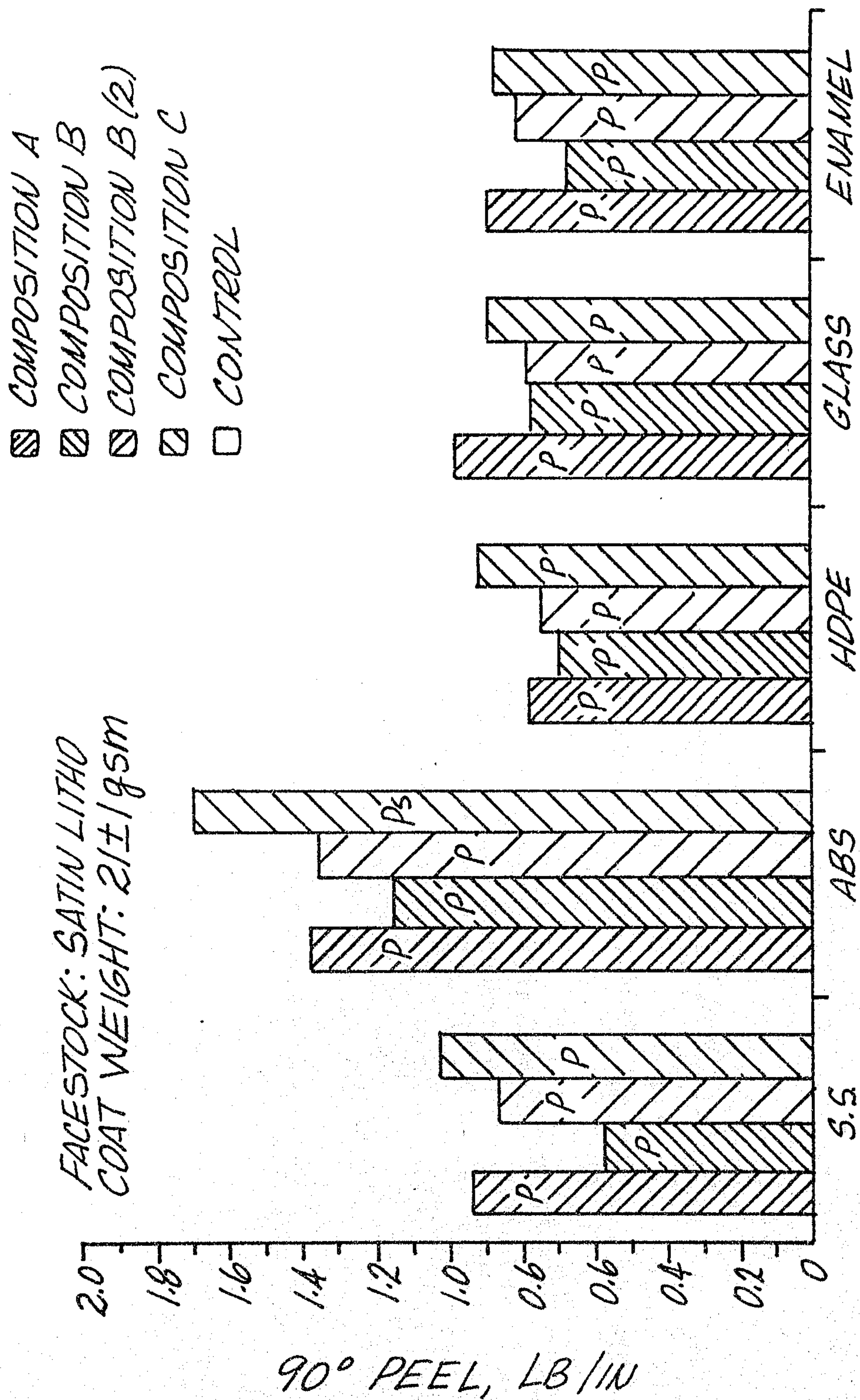
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exhibiting a second glass transition temperature greater than the first glass transition temperature, and a tackifying additive comprising at least one tackifier that is more soluble in the second elastomer than it is in the first elastomer and present in an amount sufficient to cause the dynamic mechanical spectrum of the mixture of immiscible elastomers to exhibit an increase in the second glass transition temperature and an increase in the difference between the first and second glass transition temperatures and an increase in the value of tangent delta determined at the second glass transition temperature, and in which the elastomers are present in an amount of from about 20 to 50% by weight of elastomers and tackifying additive, said pressure sensitive adhesive containing a surfactant having an HLB value greater than 7 and comprised of at least one hydrophilic polyethylene oxide block and at least one hydrophobic propylene oxide block and from 0 to about 15% by weight of the composition of a compatible wax.

75. A pressure-sensitive adhesive as claimed in claim 74 in which the surfactant has an HLB value of at least 12.

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Fig. 1



1 DAY/25°C AGING TEST

Fig. 2



7 DAY/25°C AGING DATA

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Fig. 3

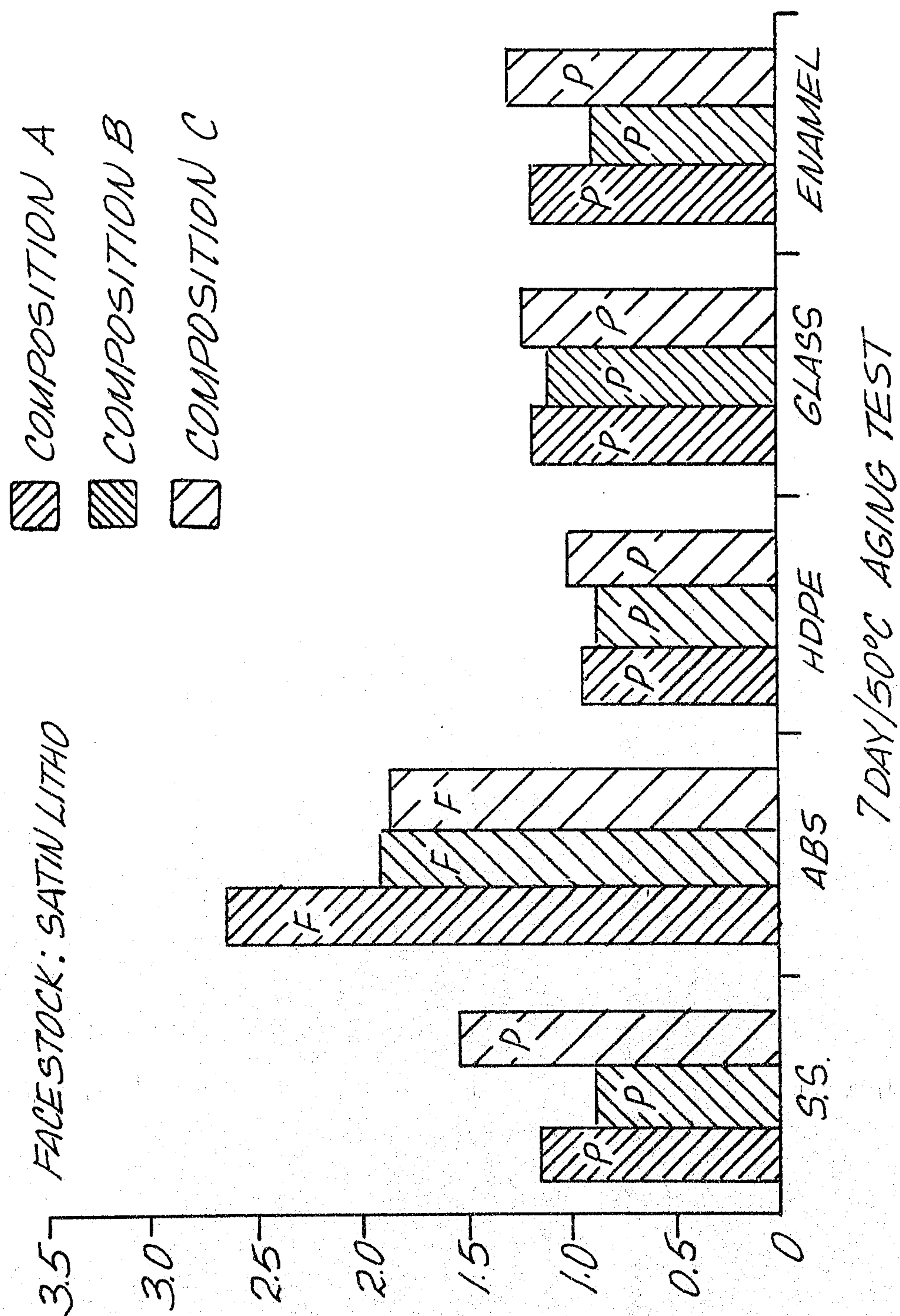
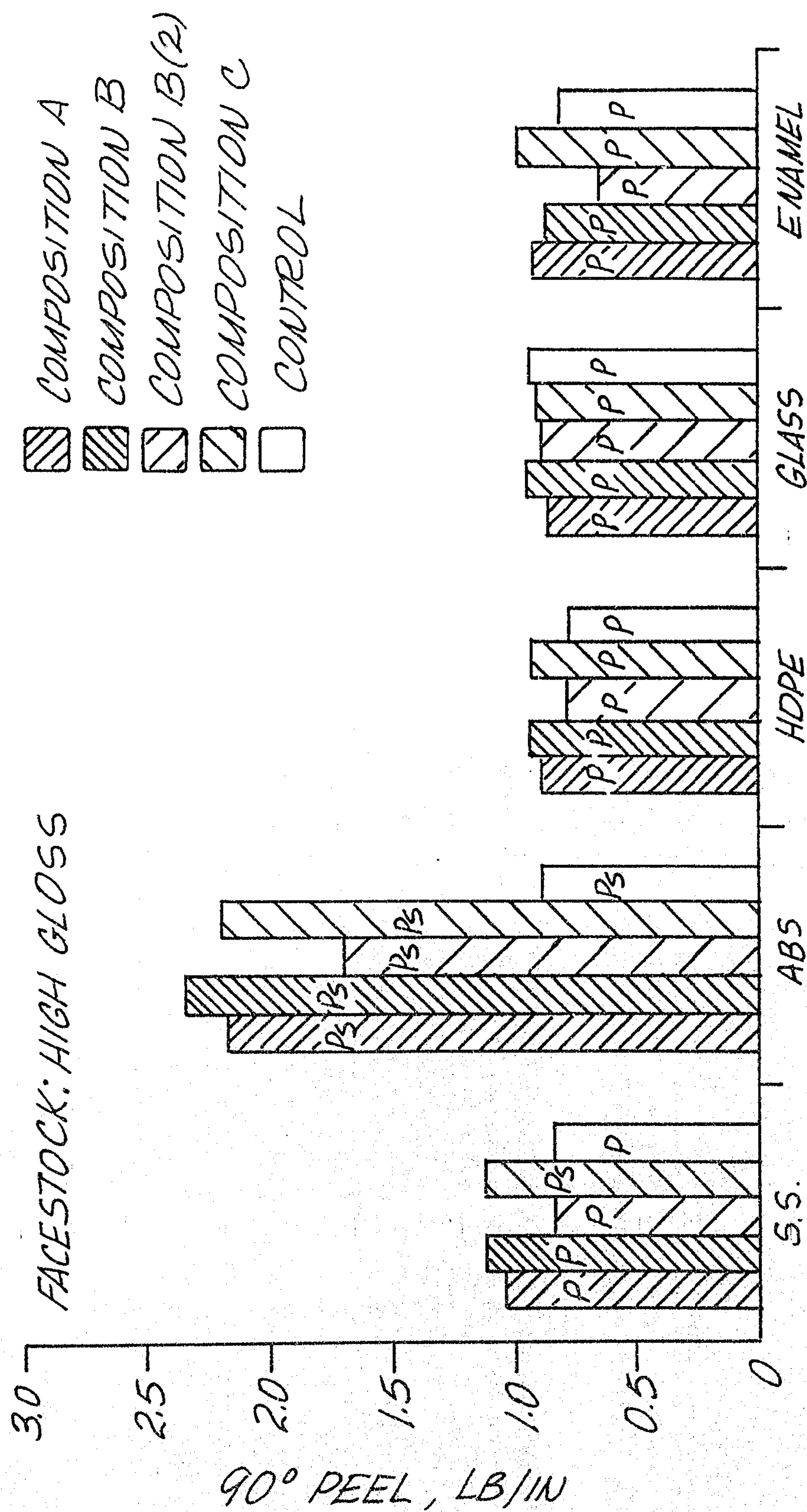


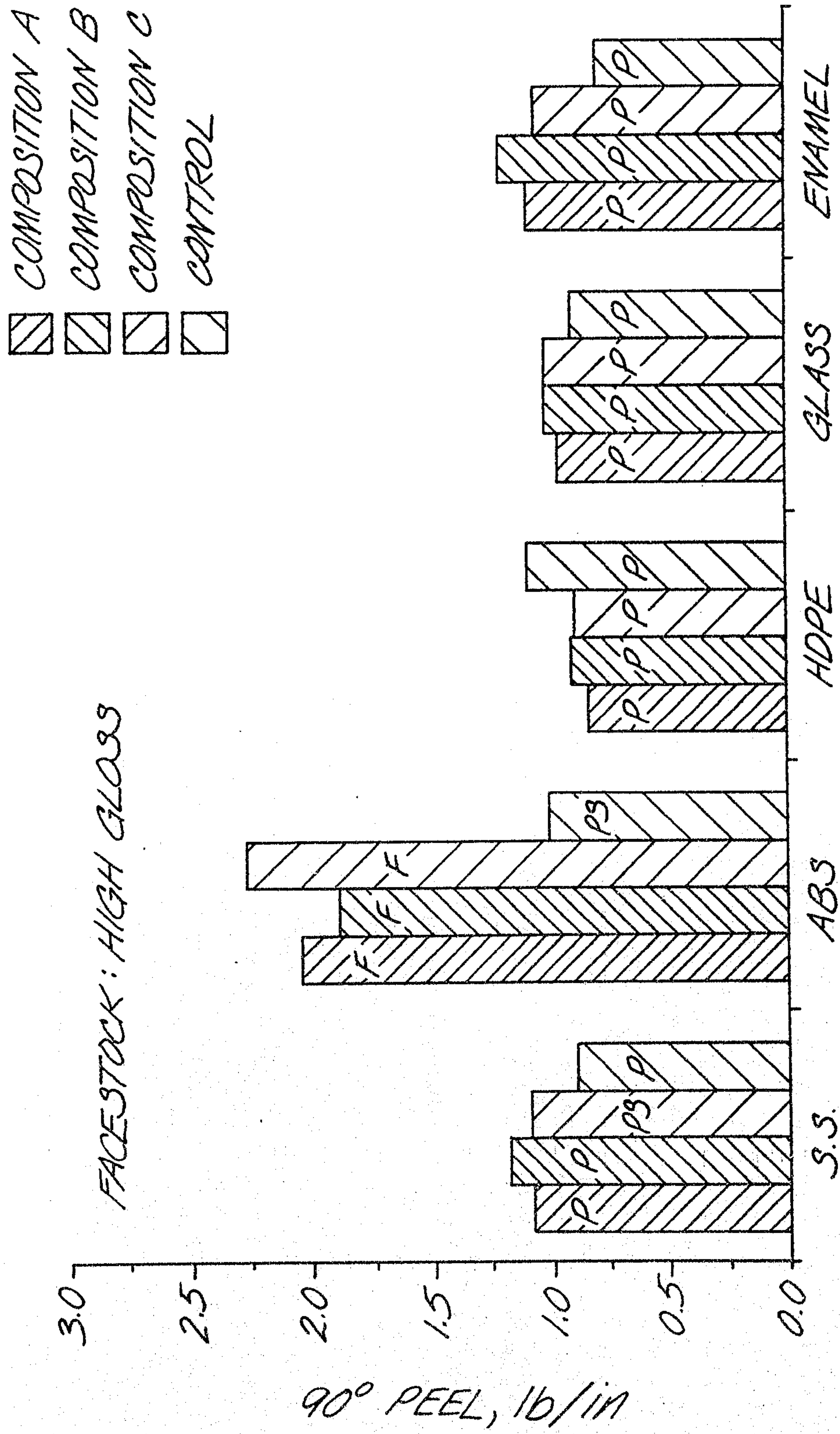
Fig. 4



1 DAY/50°C AGING TEST

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Fig. 5



7 DAY/50°C AGING TEST

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Fig. 6

FACESTOCK: HIGH GLOSS/PRIMER
COAT WEIGHT: 2 ± 1 gsm - PRONTO
17.8 gsm - FC190R

COMPOSITION A
COMPOSITION B
COMPOSITION B(2)
COMPOSITION C
CONTROL

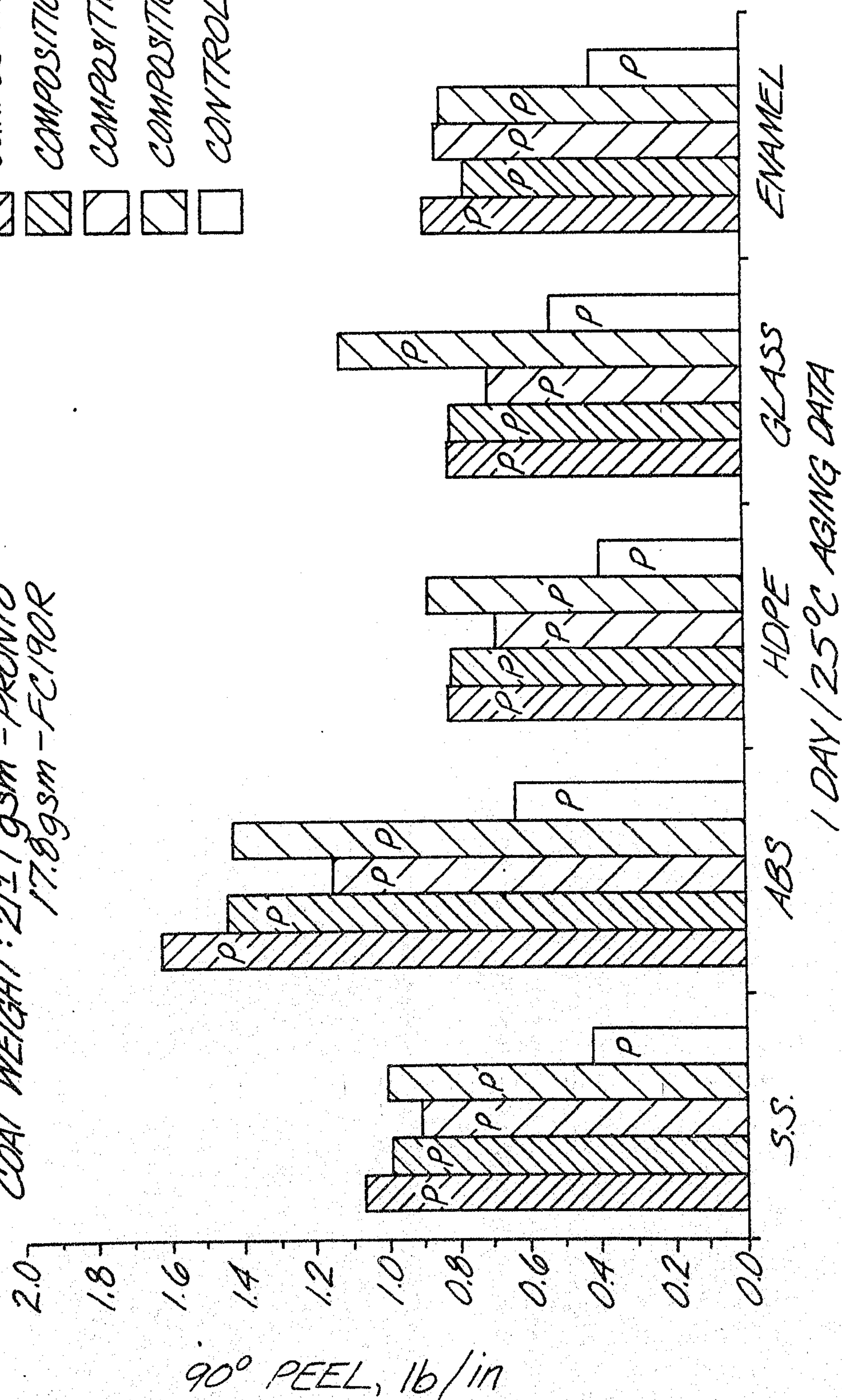
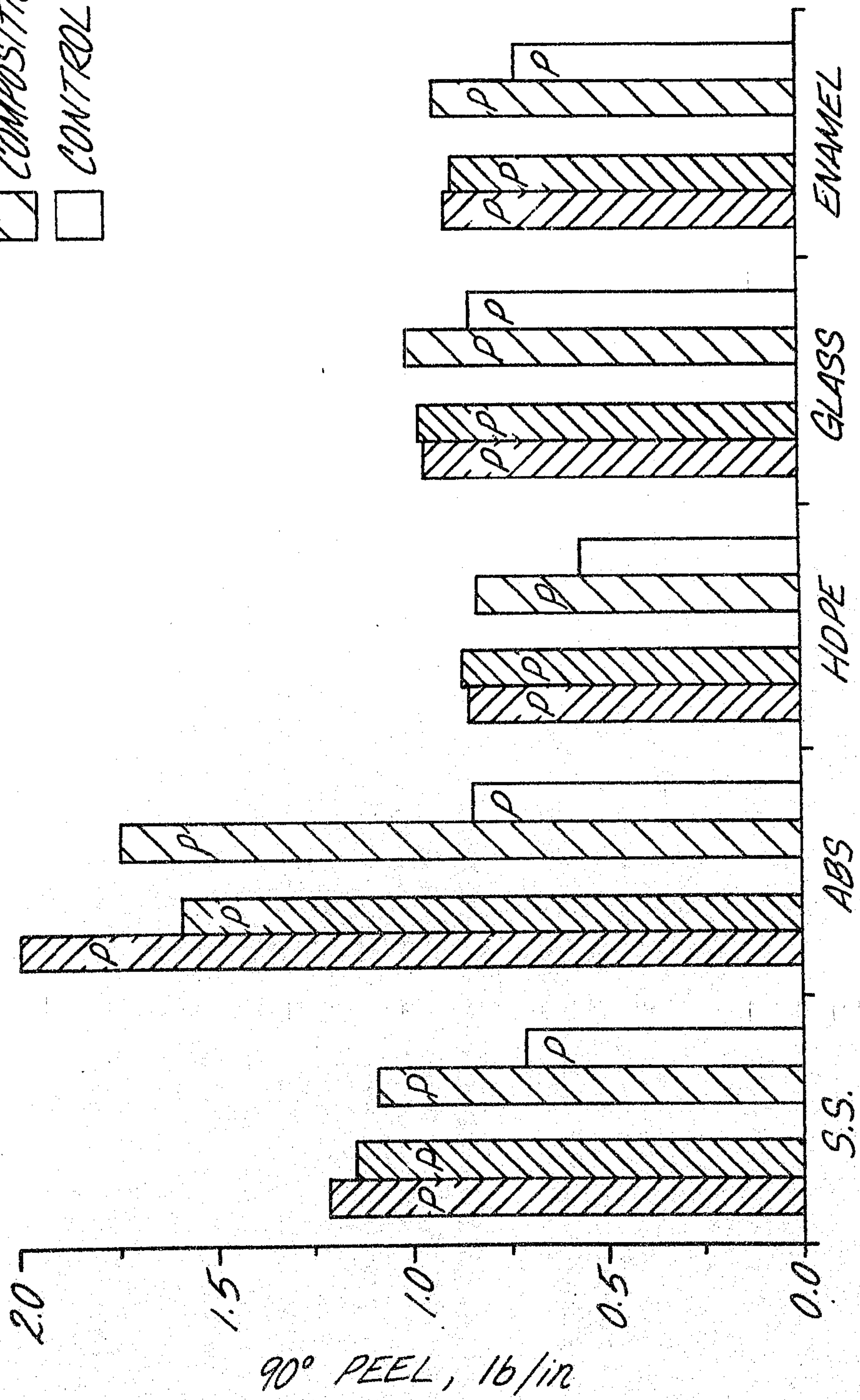


Fig. 7

FACESTOCK: HIGH GLOSS/PRIMER

- COMPOSITION A
- COMPOSITION B
- COMPOSITION B(2)
- COMPOSITION C
- CONTROL



7 DAY/25°C AGING DATA