

PRESSURE-SENSITIVE ADHESIVE POLYMERS

The present invention relates to pressure-sensitive adhesive polymers exhibiting a very good adhesion/cohesion compromise.

Pressure-sensitive adhesives in aqueous phase have experienced considerable development since the beginning of the 1970s, to replace the products in solution form, constrained by the new environmental regulations and increases in solvent prices.

Pressure-sensitive adhesives must have the following general characteristics:

- be capable of deforming under low pressures to obtain immediate wetting of the surface;
- possess sufficient viscoelastic properties to retain a permanent position after removal of the applied force.

The bonds formed by these adhesives with the substrate are of relatively low energy and many applications require a degree of cohesion which is greater than that of the adhesion (peel, tack) to obtain an adhesive failure of the surface.

The ability of a pressure-sensitive adhesive to wet a surface well can be correlated with its glass transition temperature (T_g) and with its molecular mass. In general, obtaining a T_g lower than -25°C , or even than -40°C , by copolymerization of acrylic and/or vinyl monomers in the presence of transfer agents allows the desired level of tack to be obtained.

However, the influence of the T_g and of the molecular mass on the adhesive properties run counter to their influence on cohesion.

To improve the cohesive strength of pressure-sensitive adhesives without impairing the adhesive properties, a very slight crosslinking is often employed by the use of multifunctional monomers, as described in "Recent developments in acrylic polymers for latex adhesives" RAPRA 1981, Volume 18, No. 5, Abst. 7761431c.

The incorporation of chelating monomers has also

been described in international application WO 91/02759, in order to increase the cohesion of pressure-sensitive adhesives after formulation of the latter with aluminium acetate.

Post-addition of such additives ($\text{Zn}(\text{Ac})_2$, $\text{Al}(\text{Ac})_3$) is furthermore often employed to increase the degree of cohesion of polymers containing carboxylic functional groups. However, the use of highly carboxylated latices presents problems of synthesis and of application. In fact, copolymerization of acrylic and methacrylic acid monomers in a weight proportion of polymer higher than 6 % gives rise to instability problems and entails a drop in the peel strength. Furthermore, the large difference in T_g between the acids and their salts makes the T_g of the resulting composition highly sensitive to pH variations.

The search for a good adhesion/cohesion compromise therefore continues to remain one of the preoccupations of the formulators. In this context any solution that makes it possible to improve the cohesion of a pressure-sensitive adhesive without resulting in a fall in the adhesive properties, and at a cost which is compatible with the application, offers an obvious advantage.

The Applicant Company has now surprisingly discovered that a pressure-sensitive adhesive exhibiting a high degree of cohesion associated with good adhesive peel strength and tack properties can be obtained by copolymerization of a small quantity of (meth)acrylic or vinyl monomer containing a ureido group associated with a monomeric structure containing a monomer of $T_g \geq 0^\circ\text{C}$, a monomer of low T_g , a monomer of unsaturated carboxylic acid type and a (meth)acrylic monomer which has a given ethoxylated structure, at an overall T_g of the copolymer which is lower than or equal to -25°C .

The high cohesive strength results from the introduction of the monomer(s) with a ureido structure, and the cohesion/adhesion compromise which is low is obtained by modifying the T_g of the copolymer and the

nature of the monomeric composition.

While the use of (meth)acrylic or vinyl monomers with a ureido structure is well known to improve the adhesion, and more particularly the wet adhesion of aqueous coatings, and to limit formaldehyde emissions in textile dispersions, no document has been found in the literature describing the use of these monomers to increase the cohesive strength of a pressure-sensitive adhesive. Nevertheless, in International Application 91/02759 the use of ethylimidazolidone methacrylamide in the polymer composition of Example 18 is noted, but without it being possible to ascertain a positive effect of this monomer, the increase in the cohesion being contributed by acetoacetoxyethyl methacrylate.

The subject-matter of the present invention is therefore a pressure-sensitive adhesive polymer obtained by emulsion polymerization of the mixture of the following monomers, for a total of 100 % by weight:

- (A) 40 to 95 %, preferably 50 to 65 %, by weight of at least one (meth)acrylic or vinyl monomer capable of producing a homopolymer which has a glass transition temperature lower than or equal to -40°C ;
- (B) 2 to 50 %, preferably 25 to 45 %, by weight of at least one (meth)acrylic or vinyl monomer capable of producing a homopolymer which has a glass transition temperature higher than or equal to 0°C ;
- (C) 0.5 to 6 %, preferably 1 to 3 %, by weight of at least one carboxylic (meth)acrylic monomer;
- (D) 0 to 5 %, preferably 0 to 3 %, by weight of at least one (meth)acrylic monomer ethoxylated with 1 to 20 moles, in particular 1 to 5 moles, of ethylene oxide;
- (E) 0.05 to 1 %, preferably 0.1 to 0.5 %, by weight of at least one (meth)acrylic or vinyl monomer containing a ureido group; and
- (F) 0 to 2 %, preferably 0.5 to 1.5 %, by weight of at least one acrylic or vinyl monomer carrying a sulphonate functional group,

the said polymer having a glass transition temperature

lower than or equal to -25°C , preferably lower than or equal to -40°C .

The monomers (A) exhibit a glass transition temperature which is generally between -40°C and -80°C ; they are chosen especially from butyl acrylate, n-octyl acrylate, isooctyl acrylate, 2-ethylhexyl acrylate and 2-ethylhexyl versatate. A particularly preferred monomer A is 2-ethylhexyl acrylate.

The monomers (B) exhibit a glass transition temperature which is generally between 10°C and 105°C ; they are chosen especially from methyl acrylate, butyl methacrylate, methyl methacrylate and vinyl acetate. Particularly preferred monomers (B) are methyl methacrylate, methyl acrylate, vinyl acetate and mixtures thereof.

The monomer (C) is especially acrylic acid or methacrylic acid, acrylic acid being preferred.

Examples of monomers (D), which are optional, which may be mentioned are methoxyethyl acrylate, ethyl-diglycol acrylate and ethyltriglycol methacrylate, the last one being preferred. The monomers (D) enable the loop tack and peel strength properties to be increased.

Ethylimidazolidone (meth)acrylate, ethylimidazolidone (meth)acrylamide and 1-[2-[[2-hydroxy-3-(2-propen-yloxy)propyl]amino]ethyl]-2-imidazolidone may be mentioned in particular among the monomers (E) containing a ureido group. Among these, ethylimidazolidone methacrylate is preferred.

Among the monomers (F) containing a sulphonate group there may be mentioned in particular sodium vinyl-sulphonate, sodium acrylamidomethylsulphonate and sodium allyl ether sulphonate. Among these, sodium vinylsulpho-nate is preferred. The monomers (F) make it possible to improve the colloidal stability of the dispersions for pressure-sensitive adhesive polymers, as well as the substrate-wetting properties.

The polymers according to the invention are prepared by emulsion polymerization in conditions which are well known to a person skilled in the art. The

reaction is thus preferably conducted under inert atmosphere in the presence of radical initiators. The initiation system employed may be a redox system such as $K_2S_2O_8$, $(NH_4)_2S_2O_8/Na_2S_2O_5$, Na_2SO_3 or a thermal system such as $(NH_4)_2S_2O_8$, the quantities employed being between 0.2 and 1.0 % by weight relative to the total mass of the monomers, preferably between 0.25 and 0.5 % by weight.

The emulsion polymerization reaction according to the invention is conducted at a temperature of between 65 and 85°C and depends on the nature of the initiation system applied: 65-75°C in the case of the redox systems based on peroxodisulphate and metabisulphite, 70-85°C in the case of the thermal systems based on peroxodisulphate alone.

The preparation of the dispersion according to the invention is preferably performed according to a process of semicontinuous type, making it possible to limit the drifts in composition which are a function of the differences in reactivity of the various monomers. The introduction of the monomers in the form of a pre-emulsion with a portion of the water and of the surfactants is thus generally carried out over a period of time from 3 hours 30 to 5 hours. It is also useful, although not indispensable, to perform a seeding of 5 to 15 % of the monomers. The emulsifying systems employed in the emulsion polymerization process according to the invention are chosen from the range of emulsifiers that possess an appropriate hydrophilic/lipophilic balance. The preferred systems consist of the association of an anionic surfactant, such as sodium lauryl sulphate, nonylphenol sulphate ethoxylated in particular with 20-25 moles of ethylene oxide, dodecylbenzenesulphonate and ethoxylated fatty alcohol sulphates, and of a nonionic surfactant such as nonylphenols ethoxylated in particular with 10-40 moles of ethylene oxide and ethoxylated fatty alcohols.

The total quantity of emulsifier is within the range of 2 to 4 % by weight and preferably of 2.5 to 3.7 % by weight relative to the monomers. The best

results are obtained by employing weight proportions of anionic surfactant/nonionic surfactant ranging from 25/75 to 60/40, depending on the nature of the monomers employed.

The polymer dispersions intended to be applied as pressure-sensitive adhesives according to the invention are preferably synthesized for high solids contents, of the order of 50 to 65 % by weight, to permit quick drying on application.

To obtain solids contents higher than 60 % it is furthermore preferable to control the sequences of addition of surfactants well so as to obtain the appropriate particle size distribution, to avoid a viscosity which is too high.

In order to obtain better applicability to the substrates it is preferable to adjust the rheology by the addition of a suitable thickener in small quantities: generally smaller than 0.2 % by weight relative to the final dispersion. It is also possible, though not indispensable, to add a tackifying agent, to improve the adhesion to nonpolar substrates such as polyethylene.

The polymers obtained in the process according to the invention produce pressure-sensitive adhesives which exhibit a high degree of cohesion while retaining good peel strength and tack values. These novel adhesives can thus be employed to replace the polymers in a solvent phase which are costly and detrimental to the environment.

As already indicated, the large increase in the cohesive strength is obtained by copolymerization of at least one monomer containing a pendent ureido group, such as ethylimidazolidone methacrylate. The monomers which possess these highly polar ureido groups may be the source of polar associations, such as hydrogen or dipole-dipole bonds, which will contribute to an appreciable increase in the molecular mass and will thus play a part in the viscoelastic properties of the adhesive.

The copolymerization of the ureido monomer can be performed according to a semicontinuous process in a

single stage, as well as according to a semicontinuous two-stage process, where the ureido monomer is preferably distributed in the second stage without, however, ruling out its use in the first stage.

To maintain the necessary peel strength and tack properties with good cohesive properties it is preferable to adjust the molecular mass of the polymer by employing an appropriate quantity of a transfer agent such as alkyl mercaptans (tert-dodecyl mercaptan, n-dodecyl mercaptan), alkyl mercaptopropionates or thioglycolic acid. The quantities of transfer agent according to the invention can range up to 0.25 % by weight relative to the monomers, being especially between 0.01 % and 0.25 % by weight of the monomers, preferably from 0.05 to 0.2 % by weight. It is also possible to increase the quantity of initiator employed, to reduce the molecular mass.

It has also been demonstrated that the association of at least one ethoxylated acrylic monomer as defined above makes it possible to contribute to the preservation of good peel strength and tack properties besides the good cohesive properties contributed by the monomer(s) with a ureido structure.

The high cohesive strength associated with the adhesives according to the present invention also makes them compatible with the use of tackifiers employed to increase adhesion to substrates of low surface energy, such as polyolefins.

The dispersions according to the invention can be employed alone in order to result in the formulation of pressure-sensitive adhesives that have the desired properties, and also mixed with other dispersions in formulation conditions that are judged to be optimal for the application.

Accordingly, the present invention also relates to an adhesive consisting of, or including, at least one dispersion of a polymer as defined above. It is possible, for example, to mention an adhesive consisting of a mixture (1) of at least one dispersion of a polymer as defined above and (2) of at least one dispersion of a

polymer obtained by emulsion polymerization of the mixture of the monomers (A), (B), (C) and optionally (D) and (F), which are as defined above.

In particular it is possible to mention an adhesive consisting of the mixture of (1) and (2) above, (1) representing at least 40 % by weight of the said mixture.

The present invention will now be described with the aid of examples and of comparative examples. In these examples all the "parts" and all the percentages are by weight, unless indicated otherwise.

EXAMPLE 1 (comparative)

Into a 3-litre reactor fitted with a central mechanical stirrer and a nitrogen delivery, and supporting a condenser, are introduced 36.8 parts of demineralized water, 0.265 parts of nonylphenol polyoxyethylenated with 10 moles of ethylene oxide (marketed under the trademark Synthopon®) and 0.09 parts of sodium lauryl sulphate (marketed under the trademark Texapon®). The reactor is then degassed by circulating nitrogen and its content is raised to 70°C with the aid of a water bath. Next, 0.35 parts of sodium metabisulphite are introduced, and then a preemulsion is added which has the following composition:

2-Ethylhexyl acrylate.....	56 parts
Methyl acrylate.....	41.5 "
Acrylic acid	2.5 "
Demineralized water	37.8 "
n-Dodecyl mercaptan	0.1 "
Nonylphenol polyoxyethylenated with 10 moles of ethylene oxide (Synthopon®).....	2.39 "
Sodium lauryl sulphate (Texapon®).....	0.81 "

as well as a solution of 0.35 parts of ammonium peroxodisulphate in 6 parts of demineralized water, over 3 h 30 min with stirring (100 rev/min).

When the additions are finished the reaction mixture is kept at 70°C for 1 h 30 min and is then allowed to cool to ambient temperature.

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 29°C : 480 mPa s
- Mean particle size : 214 nm
- Solids content : 55.2 %.

EXAMPLE 2 (comparative)

The procedure of Example 1 is repeated, a pre-emulsion which has the following composition being incorporated:

2-Ethylhexyl acrylate.....	56 parts
Methyl acrylate.....	38.5 "
Acrylic acid	2.5 "
Demineralized water	37.8 "
n-Dodecyl mercaptan	0.1 "
Nonylphenol polyoxyethylenated with 10 moles of ethylene oxide	
(Synthopon®).....	2.39 "
Sodium lauryl sulphate (Texapon®).....	0.81 "
Ethyltriglycol methacrylate.....	3 "

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C : 930 mPa s
- Mean particle size : 130 nm
- Solids content : 56.1 %.

EXAMPLE 3 (comparative)

The procedure of Example 2 is repeated, the 3 parts of ethyltriglycol methacrylate being replaced with 3 parts of methoxyethyl acrylate.

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C : 620 mPa s
- Mean particle size : 202 nm
- Solids content : 55.1 %.

EXAMPLES 4 to 6

The procedure of Example 1 is repeated, increasing quantities of ethylimidazolidone methacrylate being added to the composition of the preemulsion.

These quantities and the characteristics of the dispersions obtained are shown in Table 1 below.

TABLE 1

Example	4	5	6
Ethylimidazolidone methacrylate (parts)	0.2	0.5	1.0
Brookfield viscosity at 23°C (mPa s)	500	475	920
Mean particle size (nm)	227	231	165
Solids content (%)	55.6	54.8	54.2

EXAMPLE 7

The procedure of Example 4 is repeated, the ethylimidazolidone methacrylate being replaced with a formulation containing 20 % of the latter in methyl methacrylate (formulation marketed by Elf Atochem under the trademark "Norsocryl® 100").

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C : 475 mPa s
- Mean particle size : 200 nm
- Solids content : 55.7 %.

EXAMPLE 8

The procedure of Example 5 is repeated, the ethylimidazolidone methacrylate being replaced with ethylimidazolidone methacrylamide.

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C : 550 mPa s
- Mean particle size : 195 nm
- Solids content : 56.0 %.

EXAMPLES 9 to 11

The procedure of Example 1 is repeated, the monomer compositions shown in Table 2 below being employed. The characteristics of the dispersions obtained are also shown in this table.

TABLE 2

Example	9	10	11
<u>Monomer composition (parts)</u>			
Methyl acrylate	40.4	40.4	33.6
2-Ethylhexyl acrylate.....	53.8	53.8	60.6
Acrylic acid.....	2.5	2.5	2.5
Ethyltriglycol methacrylate....	3	3	3
Ethylimidazolidone methacrylate	0.3	0.3	0.3
Dodecyl mercaptan.....	0.1	0.2	0.1
Brookfield viscosity at 23°C (mPa s)	550	310	775
Mean particle size (nm)	212	239	205
Solids content (%)	55.8	55.8	55.8

EXAMPLE 12

Measurements of peel strength, of loop tack and of creep were conducted with the dispersions obtained in accordance with Examples 1 to 11. The results are reported in Table 3 below.

TABLE 3

Example	1 (com- para- tive)	2 (com- para- tive)	3 (com- para- tive)	4	5	6	7	8	9	10	11
Peel strength according to FTM*1 (N/cm)	2.6	3.9	3.7	1.2	0.8	0.1	1.1	0.8	5.8	5.0	5.4
Loop tack according to FTM9 (N/cm)	3.0	3.5	3.7	1.0	0.6	0.8	1.0	0.5	3.8	3.0	3.0
Creep according to FTM8 (min)	1364	968	724	16180	>60000	>45000	18000	>45000	36000	21250	>45000

* FTM: Finat Test Method: October 1995

EXAMPLE 13 (comparative)

The procedure of Example 1 is repeated, a pre-emulsion which has the following composition being incorporated:

2-Ethylhexyl acrylate.....	75.7	parts
Vinyl acetate.....	18	"
Acrylic acid	5.3	"
Sodium vinylsulphonate.....	1	"
Demineralized water	34.7	"
Anionic surfactant marketed by Rhône-Poulenc under the name "Adex 26 S"....	5.71	"
Nonylphenol ethoxylated with 25 moles of ethylene oxide, marketed by Witco under the name "Rewopal HV 25".....	2.50	"

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C	: 1500 mPa s
- Mean particle size	: 208 nm
- Solids content	: 56.1 %.

EXAMPLE 14

The procedure of Example 13 is repeated, 1.5 parts of vinyl acetate being replaced with 1.5 parts of a formulation comprising 20 % of ethylimidazolidone methacrylate in methyl methacrylate (formulation marketed by Elf Atochem under the trademark "Norsocryl 100").

The dispersion obtained has the following characteristics:

- Brookfield viscosity at 23°C	: 1640 mPa s
- Mean particle size	: 205 nm
- Solids content	: 55.7 %.

EXAMPLE 15

Measurements of peel strength, of loop tack and of creep were conducted with the dispersions obtained in accordance with Examples 13 and 14. The results are reported in Table 4 below.

TABLE 4

Example	13 (comparative)	14
Peel strength according to FTM1 (N/cm)	2.5	2.7
Loop tack according to FTM9 (N/cm)	3.3	4.7
Creep according to FTM8 (min)	3000	> 30 000

EXAMPLES 16 (comparative) and 17

The procedure of Example 1 is repeated, the monomer compositions shown in Table 5 below being employed. The characteristics of the dispersions obtained also appear in this table.

TABLE 5

Example	16 (comparative)	17
<u>Monomer composition (parts)</u>		
2-Ethylhexyl acrylate.....	93.5	95.0
Acrylic acid.....	2.5	2.5
Methyl methacrylate.....	4.0	-
Ethylimidazolidone methacrylate formulated as 20 % in methyl methacrylate (Norsocryl 100)...	-	2.5
Brookfield viscosity at 23°C (mPa s)	1550	960
Mean particle size (nm)	150	182
Solids content (%)	54	55

EXAMPLE 18

Measurements of peel strength, of loop tack and of creep were conducted with the dispersions obtained in

accordance with Examples 16 and 17. The results are reported in Table 6 below.

TABLE 6

Example	16 (comparative)	17
Peel strength according to FTM1 (N/cm)	3.0	1.5
Loop tack according to FTM9 (N/cm)	3.2	3.0
Creep according to FTM8 (min)	73	>30,000

Examples 19 (comparative) and 20

The procedure of Example 1 is repeated, the numerical compositions shown in Table 7 below being employed. The characteristics of the dispersions obtained are also shown in this table.

TABLE 7

Example	19 (comparative)	20
<u>Monomer composition (parts)</u>		
2-Ethylhexyl acrylate.....	97.5	92.5
Acrylic acid.....	2.5	2.5
Formulation containing 20 % of ethylimidazolidone methacrylate in methyl methacrylate	0	5
Solids content (%)	55	55
Brookfield viscosity at 23°C (mPa s)	110	550
Mean particle size (nm)	100	100

Example 21: Applicative evaluation of the latices
according to Example 19 (comparative) and
according to Example 20 and of mixtures
of these two latices

Measurements of creep and of bond strength were conducted with the latices obtained in accordance with Example 19 (comparative) and 20 and with various mixtures of these latices. The results are reported in Table 8 below.

Table 8

Content of the latex of Example 20	Creep according to FTM8 (min)	Instant tack Adhesion energy (J/m ²)
0 (Comparative Example 19)	70	320
25	400	300
30	1300	270
35	8800	250
40	>20 000	220
50	>20 000	163
75	>20 000	130
100	>20 000	110

* Measured in accordance with the method described below

The measurement of the energy of adhesion, which allows the adhesives to be classified according to the instant tack which they exhibit during a short and weak application of a probe, tests at the same time the surface properties and the viscoelastic properties in adhesive failure, without cohesive failure. The method of measurement will now be described with reference to the appended drawing, in which:

- Figure 1 illustrates diagrammatically the procedure for such a measurement; and
- Figure 2 is the diagram of the change with time of the stress applied to the adhesive.

A film (1) of each adhesive to be studied is applied onto a previously degreased aluminium panel (2). The panels thus coated are stored to dry in a controlled-environment room with a constant ambient humidity for 48 hours. Next, a probe or punch (3) is applied to the adhesives in precise conditions of time of contact of the punch on the adhesive (t_c), of force of contact (F) and of speed of rise of the punch (v).

The change with time of the stress (F) applied to the adhesive is recorded with the following probe parameters (cf Figure 2):

- I: period of application of the stress
- II: period of relaxation (formation of the bond)
- III: traction (separation of the bond).

The calculated energy of adhesion (W) corresponds to the area under the curve (after the time/movement correspondence has been established).

The latex of Comparative Example 19 is very tacky and not at all cohesive.

The mixture of the two latices makes it possible to reach a performance compromise around 40 % of the latex of Example 20 of the invention, it being known that the instant tack is judged to be satisfactory from 200 J/m² onwards.



CLAIMS

1. Pressure-sensitive adhesive polymer obtained by emulsion polymerization of the mixture of the following monomers, for a total of 100 % by weight:

- (A) 40 to 95 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature lower than or equal to -40°C ;
- (B) 2 to 50 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature higher than or equal to 0°C ;
- (C) 0.5 to 6 % by weight of at least one carboxylic (meth)acrylic monomer;
- (D) 0 to 5 % by weight of at least one (meth)acrylic monomer ethoxylated with 1 to 20 moles of ethylene oxide;
- (E) 0.05 to 1 % by weight of at least one (meth)acrylic or vinyl monomer containing a ureido group; and
- (F) 0 to 2 % by weight of at least one acrylic or vinyl monomer carrying a sulphonate functional group,

the said polymer having a glass transition temperature lower than or equal to -25°C .

2. Polymer according to Claim 1, characterized in that it is obtained by emulsion copolymerization of:

- 50 to 65 % by weight of (A);
- 25 to 45 % by weight of (B);
- 1 to 3 % by weight of (C);
- 0 to 3 % by weight of (D);
- 0.1 to 0.5 % by weight of (E); and
- 0.5 to 1.5 % by weight of (F).

3. Polymer according to one of Claims 1 and 2, characterized in that it has a glass transition temperature lower than or equal to -40°C .

4. Polymer according to one of Claims 1 to 3, characterized in that the monomers (A) are chosen from butyl acrylate, n-octyl acrylate, isooctyl acrylate, 2-ethylhexyl acrylate and 2-ethylhexyl versatate.

5. Polymer according to one of Claims 1 to 4,



characterized in that the monomers (B) are chosen from methyl acrylate, butyl methacrylate, methyl methacrylate and vinyl acetate.

6. Polymer according to one of Claims 1 to 5, characterized in that the monomers (C) are chosen from acrylic acid and methacrylic acid.

7. Polymer according to one of Claims 1 to 6, characterized in that the monomers (D) are chosen from methoxyethyl acrylate, ethyldiglycol acrylate and ethyl-triglycol methacrylate.

8. Polymer according to one of Claims 1 to 7, characterized in that the monomers (E) are chosen from ethylimidazolidone (meth)acrylate, ethylimidazolidone (meth)acrylamide and 1-[2-[[2-hydroxy-3-(2-propenyloxy)-propyl]amino]ethyl]-2-imidazolidone.

9. Polymer according to one of Claims 1 to 8, characterized in that it has been obtained by emulsion polymerization in the presence of at least one transfer agent employed in a quantity ranging up to 0.25 % by weight, especially of 0.01 to 0.25 % by weight, preferably of 0.05 to 0.2 % by weight, relative to the monomers.

10. Polymer according to Claim 9, characterized in that the transfer agent is chosen from alkyl mercaptans, alkyl mercaptopropionates and thioglycolic acid.

11. Polymer according to one of Claims 1 to 10, characterized in that it has been obtained by emulsion polymerization of the monomer mixture in the presence of 2 to 4 % by weight, preferably of 2.5 to 3.7 % by weight, relative to the monomers, of at least one emulsifying agent chosen from anionic surface-active agents, such as sodium lauryl sulphate, nonylphenol sulphate ethoxylated in particular with 20-25 moles of ethylene oxide, dodecylbenzenesulphonate and ethoxylated fatty alcohol sulphates, and nonionic surface-active agents such as nonylphenols ethoxylated in particular with 10-40 moles of ethylene oxide and ethoxylated fatty alcohols, in particular with weight proportions of anionic surfactant/nonionic surfactant ranging from 25/75 to 60/40.



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12. Adhesive consisting of or including at least one dispersion of a polymer as defined in one of Claims 1 to 11.

13. Adhesive according to Claim 12, characterized in that it consists of a mixture of at least one dispersion of a polymer as defined in one of Claims 1 to 11 and of at least one dispersion of a polymer obtained by emulsion polymerization of the mixture of the monomers (A), (B), (C) and optionally (D) and (F), which are as defined in Claim 1.

14. Adhesive according to Claim 13, characterized in that the dispersion or dispersions of the polymer as defined in one of Claims 1 to 11 represent at least 40 % by weight of the mixture.

ABSTRACT

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PRESSURE-SENSITIVE ADHESIVE POLYMERS

This pressure-sensitive adhesive polymer is obtained by emulsion polymerization of the mixture of the following monomers, for a total of 100 % by weight: (A) 40 to 95 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature lower than or equal to -40°C ; (B) 2 to 50 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature higher than or equal to 0°C ; (C) 0.5 to 6 % by weight of at least one carboxylic (meth)acrylic monomer; (D) 0 to 5 % by weight of at least one (meth)acrylic monomer ethoxylated with 1 to 20 moles of ethylene oxide; (E) 0.05 to 1 % by weight of at least one (meth)acrylic or vinyl monomer containing a ureido group; and (F) 0 to 2 % by weight of at least one acrylic or vinyl monomer carrying a sulphonate functional group, the said polymer having a glass transition temperature lower than or equal to -25°C .

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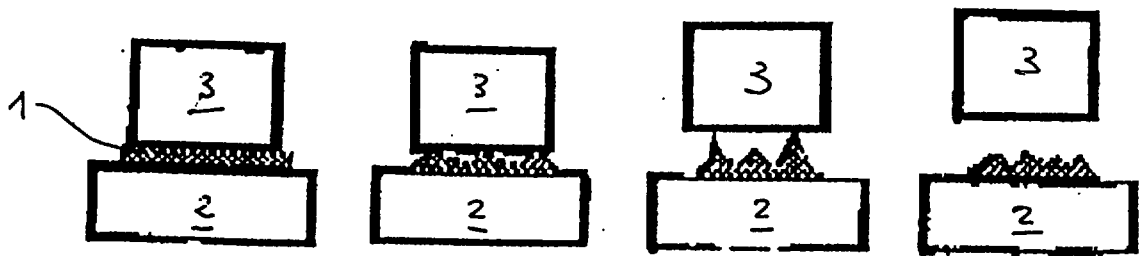


FIGURE 1

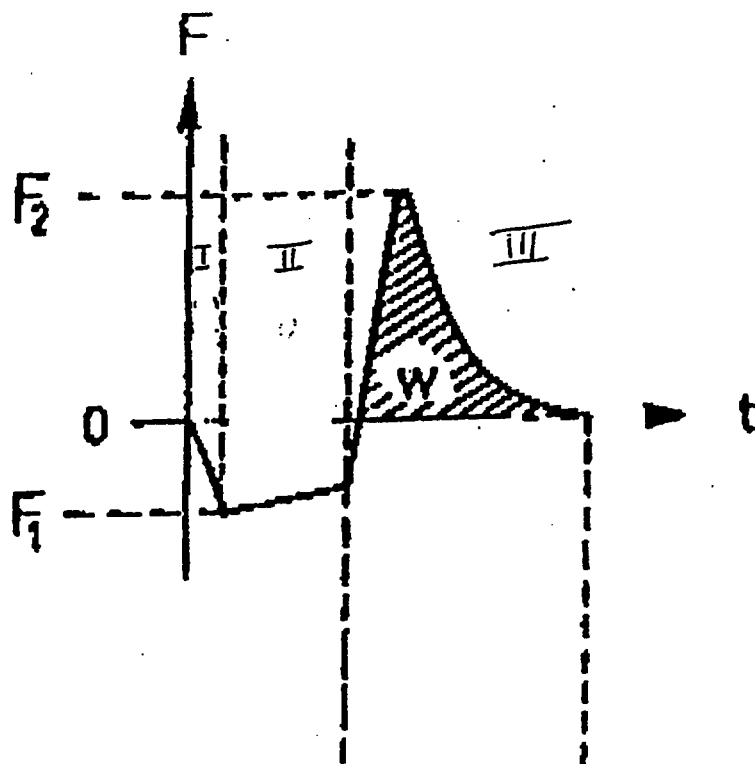


FIGURE 2

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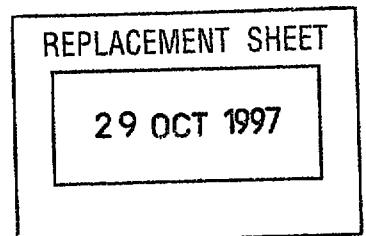
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ABSTRACT

PRESSURE-SENSITIVE ADHESIVE POLYMERS

This pressure-sensitive adhesive polymer is obtained by emulsion polymerization of the mixture of the following monomers, for a total of 100 % by weight: (A) 40 to 95 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature lower than or equal to -40°C ; (B) 2 to 50 % by weight of at least one (meth)acrylic or vinyl monomer capable of resulting in a homopolymer which has a glass transition temperature higher than or equal to 0°C ; (C) 0.5 to 6 % by weight of at least one carboxylic (meth)acrylic monomer; (D) 0 to 5 % by weight of at least one (meth)acrylic monomer ethoxylated with 1 to 20 moles of ethylene oxide; (E) 0.05 to 1 % by weight of at least one (meth)acrylic or vinyl monomer containing a ureido group; and (F) 0 to 2 % by weight of at least one acrylic or vinyl monomer carrying a sulphonate functional group, the said polymer having a glass transition temperature lower than or equal to -25°C .

(NO SUITABLE FIGURE)



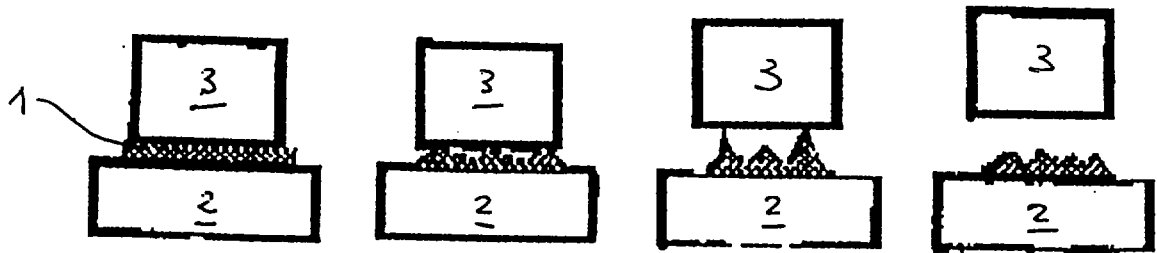


FIGURE 1

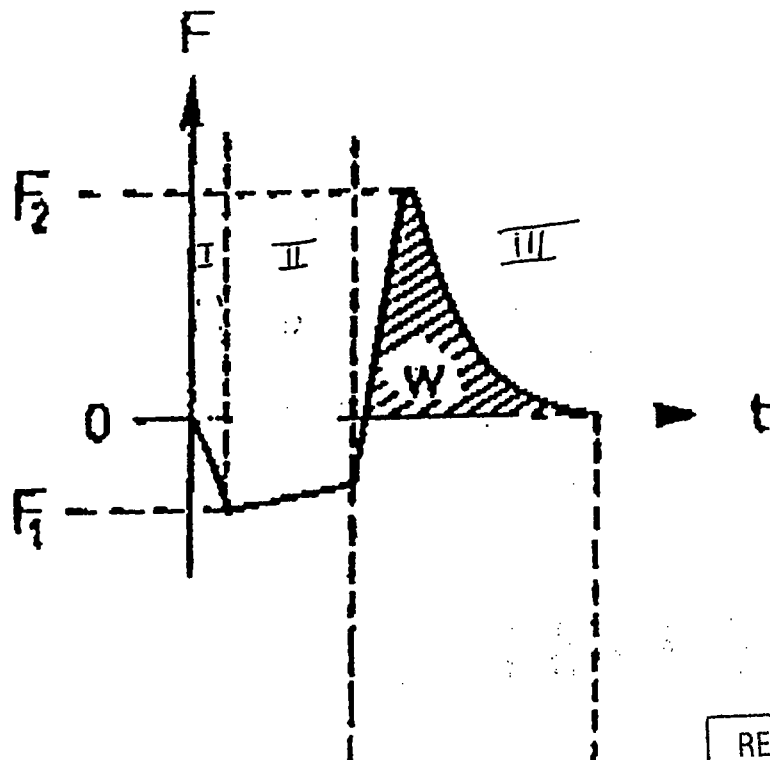


FIGURE 2

REPLACEMENT SHEET
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