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MELTING ADHESIVES WITH HIGH ADHESION

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Melt adhesives based on copolymers of ethylene and vinyl acetate (EVA) provide strong bonding at low temperatures and are not resistant to chemical reagents. New formulations of adhesives based on EVA copolymers, obtained by complete or partial saponification of acetate groups, already have higher resistance to chemical reagents.

It is known that the properties of polymer adhesives affect the choice of bonding modes and properties of the obtained adhesive joints. Of practical interest are the most significant indicators of properties, which include melting point, viscosity, adhesive (adhesive) activity. When the temperature is too high, the adhesives have a minimum viscosity, the best are the temperature conditions of bonding, at which the viscosity of the adhesives is 800— 1500 Pa · s.

An important characteristic of hot melt adhesives is the operating temperature, which is in the range of melting and destruction temperatures (temperature range). Operating temperatures of EVA copolymers were determined by the original method on a brass disk. As a polymer base for the development of the formulation of hot melt adhesive for gluing fabric, based on the analysis of EVA copolymers, was chosen copolymer EVA of the following brands: 12306-020 (TU 6-05-1636-97) and ES 28005 (LG Chem.Korea). The softening temperature in the EVA copolymer brand 28005 was 70 0C, and in the EVA copolymer brand 12306-020-75 0C, respectively, the melting point in the EVA copolymer brand 28005 - 135 0C, and in the EVA copolymer brand 12306-020-145 0C.

Analysis of work on the development of recipes for hot melt adhesives based on copolymers of EVA, found that an effective filler is silicon dioxide. Some studies describe a hot melt adhesive obtained by filling EVA copolymers with microdispersed silicon dioxide (particle size 30 μm). Hot melt adhesives based on EVA copolymer modified with microdispersed silica and recently taurite are widely used in various industries. The use of microdispersed silica and taurite as a filler can reduce the number of components of the adhesive and it has stabilizing and modifying properties.

If silicon oxide has been studied more, it was of interest to investigate the possibilities of microdisperse taurite in the development of formulations of adhesive compositions based on EVA copolymers and to compare it with silicon dioxide. Taurite, as well as silicon dioxide contains polar groups that increase the adhesion of the adhesive to the substrate, on the one hand, and contain a large number of free radicals, on the other. Taurite (shale fine powder of TS-D brand) was chosen for research, it is an active filler, modifier and plasticizer. Among other structural features of taurite, important for understanding the mechanism of its action and directions of its use, it should be noted the following: taurite is characterized by a developed inner surface and high adsorption activity against water, carboxylic acids and alcohols, phenol (14 mg / g), pyrolysis resins (20 mg / g), petroleum products (140 mg / g). The hydrophilicity of the surface, sorption and adsorption activity of taurite can be regulated by gentle oxidation of its surface (200 °C, 4—5 hours). When the taurite particles are introduced into the EVA copolymer, the supramolecular structure of the EVA copolymer is transformed due to the influence of the amorphous surface of the filler on the mobility of macromolecules. With a small amount of filler (0.5 wt.h), its particles act as heterogeneous centers of nucleation, which leads to an increase in the degree of crystallinity, and as a result, increase the strength and elasticity of the adhesive films. However, with a further increase in the concentration of the filler (more 2.5 parts by weight) its particles limit the mobility of macromolecules, which leads to a decrease in these indicators.

As a modifying additive to the composition of the developed adhesives based on copolymers of EVA selected phenol-formaldehyde resin brand 101 K.

In the developed adhesive composition, the following ratio of components, wt.%: Copolymer EVA - 10,0—25,0; phenol-formaldehyde resin brand 101 K - 5,0—15,0; filler (taurite) - 1.5—5.0; polyethylene wax - 0,5—1,0.

The adhesive ability of the developed formulations of hot melt adhesives based on EVA copolymers together with the components and without them was tested on standard gluing of 25x140 mm. Cotton and flax were used as material. After applying the glue, the samples were superimposed on each other and subjected to compression. Pressing time - 35-45 s, pressing pressure - 0.5-0.7 MPa.

After bonding, the samples were subjected to daily lying, after which the gluing was subjected to delamination on a rupture machine at a test speed of 100 mm / min. 10-15 samples were prepared for each variant of hot melt glue. This was determined by the need to ensure a confidence margin of no more than 5%. he bonding strength was compared with the bonding strength of control samples not exposed to water and temperature.

Table 1 shows the adhesion characteristics of the adhesive compositions, which were obtained by introducing microdispersed particles of silicon dioxide and taurite into the melt of the EVA copolymer.

Table 1 — Strength during bonding after tests for water resistance and heat resistance

Adhesive compositions	Bond strength, Н/см	Bond strength after water resistance tests, Н/см	Bond strength after heat resistance tests, Н/см
Copolymer + silicon dioxide	29,2	28,3	27,8
Copolymer + taurite	30,7	30,1	29,5

The increase in the adhesive properties of the EVA copolymer with the introduction of taurite filler, and as a result of increasing the bond strength, heat resistance and water resistance, probably due to the increase in the polarity of the copolymer.

The water resistance of the adhesive joints was evaluated by reducing the bond strength after holding the bonded samples for 24 hours in water. Heat resistance was evaluated by the decrease in bond strength after exposure to the bonded samples at a temperature of 45 0C for 1 hour, after which they were tested.

Developed hot-melt adhesives were made according to the following technological scheme: dosing and mixing of components, melting of a mixture of components at a temperature of 110-160 °C, extrusion (extrusion) of the mixture in the form of threads, their drawing and cooling in air, grinding into granules and drying.

The developed adhesives have a softening temperature of 80-90 oC, the operating temperature is usually 150-160 °C, curing time 3-5 seconds, bond strength 2.5 MPa.

Thus developed adhesives have high fluidity (not less than 100 g / 10 min at 160 °C) and curing time up to 30 seconds. Hot melt adhesives were developed for bonding various fabrics.

REFERENCES

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