**SEALANTS ON THE BASIS OF LIQUID THIOCOLS FOR GLAZING UNIT INSULATION**

Y.K.SHEVCHENKO, master, A.N.CHERKASHINA, PhD in Technical Sciences, L.P.PODGORNAYA, PhD in Technical Sciences

*National Technical University «Kharkov Polytechnical Institute»*

*61002, Ukraine, Kharkov, Frunze Street, 21*

*E-mail:* [*annikcherkashina@rambler.ru*](mailto:annikcherkashina@rambler.ru)

Lately there has been a steady demand for heat and energy-saving materials and constructions, among which a special place is occupied by window units out of PVC with sealed glazing units. The usage of glazing units not only improves the design of windows, but also significantly increases their operational qualities of thermal insulation, sound insulation, fire resistance and durability.

In order to reduce the cost of production and its further use in mass construction it is necessary to gradually move to a complete set of domestically produced glazing materials. This primarily concerns glass, PVC and aluminum profiles, sealants.

The consumption of hardenable sealants in the construction at the present time reaches more than a half of its total production amount. The consumption share of sealants based on polysulfide oligomers in construction sector of Ukraine generates 70%.

Sealants based on polysulfide oligomers are highly gas- and vapor-proof, for such gases as argon. The advantages of such compositions is the fact that they are able to harden and to maintain a high level of properties in a quite wide range of deviations from the optimal dosage of hardener and high stability of the sealant components during storage before usage. The advantages of sealants based on polysulfide oligomers are associated with both the nature of the main chain of the oligomer, and the activity of the terminal sour groups, which are enabling hardening, and allows its successful application in construction, where the precise weighing of components and the maintenance of temperature and humidity during the preparation and carrying out of sealing are not always possible.

In order to receive thiocol sealants except for the polysulfide oligomer different fillers, vulcanizing agents, vulcanization accelerators, adhesives, plasticizers, sometimes thixotropic and modifying additives and etc. are being used. Usually sealants are produced in the form of one, two or three-component systems.

Traditional vulcanizing agents of polysulfide oligomers are metal oxides, such as MnO2, PbO2, Pb2O3, PbO, CoO, MgO, Al2O3. The medium and the basic lead salts in combination with [tetraethylthiuram disulfide](http://www.multitran.ru/c/m.exe?t=1740277_1_2&s1=%F2%E5%F2%F0%E0%FD%F2%E8%EB%F2%E8%F3%F0%E0%EC%E4%E8%F1%F3%EB%FC%F4%E8%E4) or lead dioxide together with sulphates or chlorides of sodium, zinc, barium, tin, cadmium, and oxides of calcium, barium, strontium, sulfur chloride are being used (I) [1].

Despite this variety of metal oxides, capable of enabling hardening of polysulfide oligomers, only lead manganese dioxides are used only on industrial scale, which are used in mixtures, deposited on such fillers as kaolin, titanium dioxide [2].

In two-and three-component sealants lead and manganese dioxides are used in the form of prepared vulcanizing pastes. Usually in the composition of such pasts dibutylphthalate or other high-boiling, non-toxic plasticizers are added as solvents [3].

Sealants are an important component in the system of insulating glass production, because its insulating properties have a direct impact on the main characteristics of the product. The quality of sealants for insulating glass production according to the testing procedures adopted by all international certification authorities, is determined by the following parameters: 1 - durability index of a material in a product, 2 - Shore hardness (standard from 40 to 60), 3 - vapor- permeability of a sealant 4 - adhesion of a sealant to glass and spacer, 5 - sustainability and compatibility of a sealant with a moisture absorbent and inert gases for glazing unit filling.

There are different formulations for sealant compositions, for example, containing polysulfide oligomer, carbon black, vulcanizing agent - a mixture of dimethylaminomethyl-phenol and a vulcanization accelerator oligodiethylenemaleate at the following ratio, parts by weight: polysulfide oligomer - 100.0; carbon black - 30-50; oligodiethylenemaleate - 20-30; a mixture of dimethylaminomethylphenol - 1-2. Maybe a sealant composition has been used comprising: a polysulfide oligomer, filler - carbon black, manganese dioxide, plasticizer - dibutylphthalate, stearic acid, aerosil, diphenylguanidine, modifying agent - б, щ-metkakylbispentaerythriteadipate at the following ratio of components, parts by weight: polysulfide oligomer-72,0-82, 0; carbon black - 18,0-28,0; manganese dioxide - 4,9-6,7; - dibutylphthalate - 3,8-5,1; stearic acid – 0,02 - 0,03; aerosil – 0,15–0,19, diphenylguanidine – 0,6-1, б, щ-metkakylbispentaerythriteadipate – 3,0-7,5. The sealant composition is proposed comprising of polysulfide oligomer, filler, manganese dioxide, a plasticizer, stearic acid, aerosil, diphenylguanidine and modifying agent. As the modifying agent an unsaturated polyester resin has been used, which is obtained by polycondensation of norbornenedicarboxylic acid and maleic anhydride mixture at molar ratio of 4: 6 with a mixture of ethylene-glycol and diethylene-glycol, with a molar ratio of 3: 7, at a molar ratio of acid anhydrides and glycols 1:1. However, the proposed sealants have high physical and mechanical properties, but insufficient adhesion to glass and duralumin.

Therefore, there has been an attempt to develop a new formulation of a sealant composition with improved adhesion to glass and duralumin, as it is planned to use it for [glazing unit](http://www.multitran.ru/c/m.exe?t=1509066_1_2&s1=%F1%F2%E5%EA%EB%EE%EF%E0%EA%E5%F2) insulation.

This problem has been solved by creating a new formulation of a sealant composition comprising a polysulfide oligomer, a filler - hydrophobic calcium carbonate, manganese dioxide, a plasticizer – dibutyl-phthalate, stearic acid, aerosil, diphenylguanidine and a modifying agent, which is an unsaturated polyester resin obtained by polycondensation of norbornenedicarboxylic acid anhydride and maleic anhydride mixture at a molar ratio of 4:6 with a mixture of ethylene-glycol and diethylene-glycol, with a molar ratio of 3:7, at a molar ratio of acid anhydrides and glycols 1:1, at the following ratio of composition components, parts by weight: polysulfide oligomer - 100.0; hydrophobic calcium carbonate - 75.5 - 125.0; manganese dioxide - 6.5 - 8.0 , dibutyl-phthalate - 5.2 - 9.5, stearic acid - 0.1 - 0.5, aerosil - 0.25 - 3.5; diphenylguanidine - 0,2 - 1,5; modifying agent - 0.5 -3 , 5.

By achieving an even distribution of components, the sealing composition has been heated at 20є C during 7 days or at a temperature of 70є C during 24 hours. The following physical and mechanical properties have been studied: lifetime - 40 ± 10 min.; Elongation percentage % - 160, relative rate of set - 10, Shore A – 55, peeling strength from silicate glass, MPa - 1,98.

As showed, the developed sealant composition has an enhanced adhesion to glass and duralumin. Moreover, the composition exhibits high strength and hardness, but less lifetime that contributes to the increase the amount of sealant production.

1.Аверко-Антонович Л.А., Кирпичников П.А., Смыслова Р.А. Полисульфидные олигомеры и герметики на их основе. - Л.:Химия,1983,128 с.

2.Клеящие материалы. Герметики. Справочник / Под ред..А.П.Петровой. Санкт-Петербург, НПО «Профессионал», 587 с.

3.Смыслова Р.А., Котлярова С.В. Справочное пособие по герметизирующим материалам на основе каучуков. - М.: Химия, 1976, 72 с.