Estimation of Strength of Coating of Solvent Layer on the Basis of Adhesive Building Mixture

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Abstract. The article provides the information on the technique for estimating the strength of adhesion of a solution layer on the shear. The means for the strength of adhesion measuring, their metrological characteristics are proposed. The appearance and operation principle of the GT 2.2.3 device is described. A technique for assessing the strength of adhesion of tile adhesives to the shear using a GT 2.2.3 device is described. The information is given on the results of testing of an adhesive layer on the basis of a cement substrate. It is shown that the tensile stresses appearing in the adhesive layer are less than the tensile strength at shearing, and the shear strength exceeds the values of the maximum tangential stresses.

Keywords: dry construction mixtures, adhesive layer, adhesion strength, shear, methods.

1. Introduction
One of the most promising segments of the construction materials market is the production of dry construction mixtures (DCM). DCM must meet modern operational requirements. One of such requirements for solutions based on DCM is the strength of adhesion to the substrate.

In accordance with the current DIN EN standards, the existing adhesion strength test procedure provides for the separation of the solution layer from the substrate [1-12]. Meanwhile, the dissolution layer during operation They also undergo shear loads relative to the substrate [13]. In accordance with GOST 14759 "Adhesives. The shear strength method" shear strength is determined on a test machine that allows tensile testing [14]. However, the technique involves the use of metal plates as substrates, and as a glue - polymer compositions.

An analysis of scientific, technical and patent literature indicates that at present there is no method for determining the adhesion strength of shear thinning layers based on DCM.

2. Methods
We have proposed an estimate of the shear strength of shear bonding with the help of the device GT 2.2.3 (Figure 1) [15,16].
The mechanism of the GT 2.2.3 device is the creation of a horizontal shear load on the sample in the test installation on the basis of the test composition. The force created by the reduction gear is transmitted to the movable carriage of the shear box and measured by a force sensor (Figure 2).

The test sample is placed in the carriage of the device in such a way that the substrate is in a small shear ring, and the test composition is in a large shear ring. The technological gap of 1 mm forms the cut-off area. During the test, as the tangential load applied to the lower shear ring increased, the value of the shear strains of the test composition relative to the substrate was recorded.

This technique and GT 2.2.3 instrument were used to determine the shear strength of the solvent adhesive layer relative to the substrate. A tile adhesive was used for the tests on the basis of the developed formulation of the dry glue mixture. The developed adhesive formulation contains Portland cement, mineral aggregate (sand), plasticizer, polymer and mineral additive [17,18].

For the tests, cement bases of cylindrical shape were used, the geometric dimensions of which are 71.4 × 15 mm. On the bases, the test composition of a tile adhesive with a thickness of 5 mm was applied [19]. The optimum shear rate of the solution adhesive layer is 0.2 mm / min. The samples were tested according to the scheme shown in Fig.3. For testing, bases were prepared on a cement-sand base of cylindrical shape, the geometric dimensions of which were 71.4 × 15 mm. After hardening, the test composition 10 mm thick was applied to the bases.
The test sample was placed in the carriage of the device in such a way that the bases was in a small shear ring 2 and the test composition in a large shear ring 3 (Fig. 1). The remaining volume of the large shear ring was filled with a gypsum test to ensure better fixation of the sample and an even distribution of the load on it. The technological gap of 1 mm forms the cut-off area. During the test, as the tangential load applied to the lower shear ring increased, the value of the shear strains of the test composition relative to the base was recorded.

To measure the homogeneity of the data obtained during the experiment using the proposed technique, the coefficient of variation was determined. The shear strength values obtained during the series test were used for the calculation. The root-mean-square deviation when testing a series of samples is 3-6 kPa. The resulting coefficient of variation is equal to 1.5-2.6%, therefore, the variability of the variational series can be considered insignificant. The measurement error of the instrument itself is 0.5% of the measuring range.

3. Test results
The results of testing the glue layer on the basis of cement glue on a cement bases are shown in Figure 4.

![Figure 4. Shear-based cement slip shear test.](image)

The analysis of the data showed that the adhesion strength on the shear of the solution layer on the basis of the developed formulation of the tile adhesive is 0.92 MPa, which meets the requirements imposed on the adhesion strength of the adhesive layer [20].

4. Conclusions
The proposed technique for estimating the strength of adhesion to shear allows us to take into account not only the adhesion strength of adhesive adhesion to the substrate, but also the shear bond strength. Having such data it is possible to speak about the adhesion strength of the adhesive layer to the substrate.

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