tent of the polymer the kinetics of polymer concrete decomposition in acid media has been investigated.

The data got at the investigation of the air content dependence on the polymer-cement ratio in the mortar modified by ВДВХМК-65Е-ВДК (Fig.1) testify that in the area conforming to 7-10% content of the polymer from the cement mass the decrease of air entrainments and increase of the forming closed pores number, the result of which is receiving the polymer-cement frame possessing maximal chemical durability.

The possibility of cement systems lifetime increase in aggressive media owing to their modification by chemically resistant water dispersion has been established in principle.

For the purpose of establishing modified concretes' corrosion resistance the tests in various aggressive media: nitric, sulfuric and hydrochloric acids and also solutions of sodium chloride and sulfate, were carried out. The corrosion resistance was estimated on the modified materials' strength properties loss, when cured in 10% aggressive medium.

Due to the carried out experiments it is established that on the intensity degree of the effect on the modified mortars' physical and mechanical properties the investigated aggressive media represent the following comparative range: hydrochloric acid > sulfuric acid > nitric acid > sodium sulfate > sodium chloride > benzine. In salt solutions the modified materials' durability increases considerably compared to the non-modified ones.

The mathematical treatment of the experimental data inclusive of the works performed by the research workers of A.F. Polak's school, Ivanov F.M., Rozental N.K. and others allowed the author to suggest a calculation formula for the modified concretes' and mortars' durability definition depending on the aggressive agents in the exploitation medium:

$$\tau = -\frac{1}{A_0 \eta}\left[\frac{L}{L_0}\right]^2, \qquad (1)$$

where η - is the aggressive substance concentration in the exploitation medium; L – the thickness of the construction being subjected to the exploitation medium's aggressive effect, (cm); L_0 – the laboratory sample thickness (4 cm); A_0 – the constant defined experimentally by the errors sum-of-squares minimization on the formula (A_0 <0):

$$A_0 = \frac{\sum_{i=1}^{M} \eta_i t_i \ln\left(S_i / S_0\right)}{\sum_{i=1}^{M} \eta_i^2 t_i^2}, \qquad (2)$$

where S_i – is the sample strength [kg/cm^2] after being cured in the aggressive medium for the time t_i; m – the number of measurements carried out for every sample; S_0 – the sample strength initial value [kg/cm^2]; η – the mortar concentration ($0<\eta<1$).

The established functional dependence and corrosion resistance of the modified mortars and concretes in acidic and salt aggressive media allow forecasting a material's lifetime and, consequently, structural units' durability as a whole at the anticorrosion protection design stage already.

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TECHNICAL SILICON REFINING

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Silicon is widely used in various branches of industry. So, due to its ability to create valuable alloys with unique properties *Si* is used for making rust-resistant pipes when obtaining silicon steel for electrical industry, in transformer, instrumental, corrosion-resistant, heat-proof, spring, constructive and other steels. Silumins (silicon and aluminum alloys) applied in space and aviation, automobile, instrument-building and other industries; corrosion-resistant silicon bronzes, silicon and magnesium alloys, abrasive materials based on silicon carbide are widely known. Silicon is used for the production of a wide range of organic silicon compounds. The ultrapure *Si* – is the main semi-conducting material for transistors, current rectifiers, radio waves enhancers, controllers, electronic chips for computing devices. Silicon serves as the basic material for making photoelectric converters (PEC) as well [1].

The technical (metallurgical) silicon (Si_{tech}) is obtained by the carbo-thermal method out of silica-containing raw material in electric arc furnaces on the general reaction: $SiO_2+2C=Si+2CO$ [2,3]. The Si_{tech} obtained at the melting process dissatisfy the consumer requirements on the ultimate product chemical purity. That is why refining is practiced nowadays.

A complex operation of refining should reduce the content of *Al*, *Ca*, *Fe*, *Ti* and other admixtures in the silica and also fully remove small and big slag pockets. The silicon refining methods (those not introduced into production as well) at the national and overseas plants are based on the following physical and physico-chemical phenomena:

- the slag separation by settling the liquid for coagulation and separation of small inclusions into a single phase;
- the slag separation by the silicon remelting and settling an additive agent of the degassing flux;
- the separation of metallic impurities by their transferring into fugitive chlorides and fluorides by blowing with gases or solid additions gases;

- the same with an additive oxidative agent - O_2 and transfer of the admixtures (*Ca, Al* and others, for example) into oxides passing into slag;

- the purification of powdery silicon in solid by halogens, chlorhydric or sulphuric acids, etc.; the ultimate product being the refined silicon powder;

- the silicon treatment in plasma.

The main method of Si_{tech} commercial refining at the CJSC "Kremny" (Shelekhov, Irkutsk Region) – is the oxidizing-flux one performed in scoops by air blowing (with adding siliceous sand as the flux) [4]. We carried out the pilot plant tests on the operating equipment of the enterprise by two refining methods. 1. The refining of Si_{tech} by the oxidating method with the following crystallization was performed at the following parameters: the compressed air flow = 29-34 m^3/h; the melt temperature = 1550-1570^{0}C; the gas- and air mixture supply increase up to ≈0,6 MPa; the blowing time = 16 hours; the silicon crystallization period = 48 hours.

2. The refining of Si_{tech} by the oxidating method by blowing the melt with oxygen-rich air was performed (without adding fluxes) at the following process variables: the pressure in the oxygen and compressed air supply lines ≈0,5 MPa; the melt temperature = 1472-1481^{0}C; the refining time (average) = 1,5 hours; the consumption indices of oxygen, compressed air, m^3/h, accordingly: 4; 19,5. After the carried out tests the degree of Si_{tech} refining from principal impurities made, %, accordingly: on the first method - *Fe* - 97,27; *Al* - 95,5; *Ca* - 99,64; on the second method – *Fe* - 6,7-8,2; *Al* - 70; *Ca* - 94,95.

Thus, the silicon refining procedures suggested allow obtaining refined silicon of high chemical purity without significant changes of the process flow sheet existing at the plant.

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References:

1. Nemchinova N.V., Klyots V.E., Nepomnyashchikh A.I. Silicon in XXI century // Basic research – M.: Academy of Natural History, 2006 – N12 – pp. 13-17.

2. Technical silicon melting technology / under the editorship of Katkov O.M. – Irkutsk: CJSC "Kremny", 1999 – p. 245.

3. Popov S.I. Silicon metallurgy in three-phase ore-smelting furnaces – Irkutsk, 2004 – p. 237.

4. Borisov, N. Nemchinova, S. Popov. The silicon production technology improving for its application extending // Proceedings of the International Scientific Conference «Silicon for the Chemical and Solar Industry IX», Oslo (Norway), June 23-26, 2008. – Trondheim: NTNU, 2008. – P. 37-50.

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ADVANCED FEATURES OF OIL-BEARING STRATA VERTICAL AND LATERAL HETEROGENEITY MAPPING AND STUDYING USING INFORMATION MEASURES

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As a rock characteristics heterogeneity measure in a vertical geological cross section the coefficient of relative entropy (Pelto, 1954; Yaglom, Yaglom, 1960; Dementyev, Khitrov, 1966; Ozhgibesov, 1975) was used.

$$K_{\Phi} = \frac{-\sum_{i=1}^{n} p_i \log p_i}{\log N} \quad (1),$$

where K_{Φ} – is the coefficient of relative probability entropy (coefficient of facial heterogeneity); n – the number of group intervals of the measured parameter; p_i – the probability of the observation result fall within the i-th group interval; N – the number of group intervals of the measured parameter (here N=10, that is why the denominator represented as a common logarithm is equal to 1).

The first extremal case. The petrophysical rock properties parameters' amplitudes have been studied on the bore well logs.

It goes from the formula (1) that at n = 10 and p_i = 0,1 the K_{Φ} value is equal to 1. In the calculations we used the logarithm to base 10. The considered case conforms to the *maximal heterogeneity* of the vertical section of the isochronal stratigraphic range chosen. The number of facial rock types is equal to 10.

The second extremal case. If the vertical section is homogeneous, all the values of amplitudes in the well log fall within the same grouping class. In this case p_i = 1, and the K_{Φ} value is equal to zero, as log 1 = 0. The number of facial rock types in the vertical section is equal to 1.

Present-day computer technologies allow getting in the shortest time such vertical section heterogeneity complementary information, which is impossible to get in other ways. This heterogeneity can also be mapped.

For the geological section heterogeneity problem solution on the GC, OGC, SP and RC diagrams we applied the computer programs, which allow analyzing and interpreting the well information quickly using standard petrophysical algorithms and also making the relative section entropy map.

The use of the relative entropy coefficient for the evaluation of vertical section lateral variability has an advantage of other ways of mapping of facies re-