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LIGHTWEIGHT TUMPING MORTAR BASED ON LOCAL RAW MATERIALS FOR CEMENTING OF WELLS IN THE CONDITIONS OF THE USTURT REGION

Yodgorov N.N.
Doctoral student at Tashkent State Technical University named I.A. Karimov

Abdinazarov A.A.
Assistant teacher at Tashkent State Technical University named I.A. Karimov

ABSTRACT

Geological and physical conditions and peculiarities of the development of deposits of high-viscosity oils are given. To study the causes of flooding production of wells, dependencies have been made on the development period, the utilization factor of reserves and the recovery factor of oil. It is established that the rate of watering the production of wells depends on the activity of the water-pressure system.

KEYWORDS: ***deposit, deposits, horizon, reservoir, watering, development, dependence, water system, activity, rate, selection, coefficient, washing, liquid.***

INTRODUCTION

A decrease in the density of the grouting slurry is achieved by replacing a part of the cement with a filler having a lower density than cement and a higher specific surface area and an increase in the water content of the solution. Special lightweight cements produced by factories make it possible to obtain a solution density in the range of 1490-1550 kg / m3. The use of diatomite as a filler makes it possible to reduce the density of the grouting mixture to 1400-1500 kg / m3. Also, lightweight grouting mixtures with a density of 1250-1350 kg / m3 are obtained by adding gas-filled micro cylinders made of polymer resins, but they are expensive and difficult to obtain imported materials. [1]

In the conditions of the Ustyurt oil and gas region, when cementing technical and production strings, according to the regulations, the density of the cement slurry should be in the range of 1400-1500 kg / m3. To ensure such a density of the cement slurry, studies were carried out on the use of readily available and inexpensive lightweight additives available in our Republic. On the basis of research on obtaining formulations of lightweight grouting slurries, we have proposed brown coal powder as a lightening additive, which is used in drilling enterprises for the preparation of CAR paste. To adjust the period of thickening of cement slurries, NTMP, FHLS, CMC - 500 were used. Due to the replacement of a part of the cement with brown coal powder, the density of the cement slurry decreased to 1400–1500 kg / m3. [2,3] In addition, experimental studies were carried out to identify the effect of brown coal powder on the properties of cement slurries and the cement stone formed on the basis of them. The studies were carried out at temperatures from 20 to 100 0C. The results of the study to determine the optimal composition and the effect of the content of brown coal on the strength characteristics are shown in Table 1.

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Table 1.
Influence of brown coal powder on the strength characteristics of lightweight cement slurry (T = 200C)

№ p/p	Composition of cement slurry, wt%					Indicators of grouting slurry			
	Cement	dolomite	brown coal	CMC	V/TS	γ, g/см³	d., см	$G_{изг}$, MPa	$G_{сж}$, MPa
1	100	-	-	-	0,7	1,65	25	1,4	3,8
2	80	-	20	-	0,6	1,57	25	1,4	3,8
3	70	-	30	-	0,6	1,53	25	1,3	3,5
4	60	-	40	-	0,6	1,49	25	1,2	3,6
5	60	-	40	-	0,7	1,40	26	1,2	3,6
6	60	20	20	-	1,0	1,35	23	0,5	1,6
7	60	15	25	-	0,9	1,40	25	0,6	1,9
8	60	10	30	-	0,9	1,45	25	0,7	2,2
9	100	-	-	0,5	0,7	1,65	23	2,0	4,5
10	80	-	20	0,5	0,6	1,57	23	2,0	4,5
11	70	-	30	0,5	0,6	1,53	23	1,8	4,2
12	60	-	40	0,5	0,6	1,49	23	1,6	3,9
13	60	-	40	0,5	0,7	1,40	24	1,6	3,9
14	60	20	20	0,5	1,0	1,35	21	0,7	2,2
15	60	15	25	0,5	0,9	1,40	23	0,9	2,4
16	60	10	30	0,5	0,9	1,45	23	1,1	2,7

As can be seen from the data in Table 1, on the basis, with an increase in the content of brown coal in the composition, the specific gravity of the lightweight cement slurry increases to 1.57 g / cm3. However, the strength of the grouting slurry is slightly reduced in comparison with the strength of the cement stone obtained from pure cement. With the help of CMC, the terms of thickening of grouting slurries are regulated, in addition, CMC contributes to an increase in the strength of the cement stone, as evidenced by the data in Table 1 (p. 9-16). Based on our studies, we obtained the following compositions of a lightweight grouting solution:

1) For cementing production strings:
Backfill cement. % - 60-50
Brown coal masses. % - 20-50
Dolomite masses. % - 10-15
V□C ratio - 0.6-0.7

2) for cementing technical columns:
Backfill cement. % - 60-50%
Brown coal masses. % - 20-30%
Dolomite masses. % - 10-20%
V□C ratio - 0.9-1.0

Tests of the formulation of a lightweight cement slurry based on brown coal were also carried out in the CETS laboratory of the Ustyurt URB at a temperature of 100 ° C and 40 ° C. The test results are shown in Table 2.

Table 2
Composition and properties of lightweight cement slurry based on brown coal

№ p/p	Composition of the cement slurry,% by weight					Indicators of grouting slurry				T⁰C
	cement	dolomite	brown coal	NTMP	V/TS	G, g/см³	$d_{нач.}$, см	$T_{зач.}$, hour-minute	$d_{кон.}$, см	
1	100	-	-	0,1	0,7	1,65	25	6-05	15	100
2	80	20	-	0,1	0,8	1,57	25	5-20	11	100
3	70	-	30	0,08	0,6	1,53	22	5-30	13	100
4	60	-	40	0,08	0,6	1,49	22,5	5-50	12	100
5	60	-	40	0,08	0,7	1,40	22,5	6-10	15	100
6	100	-	-	0,02	0,7	1,65	25	5-30	14	40
7	70	-	30	0,02	0,7	1,52	25	5-30	12	40
8	60	15	25	0,02	0,7	1,45	25	5-30	13	40

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From the data in Table 2, it can be seen that as a result of the addition of 25-40% brown coal to cement, it is possible to obtain a lightweight grouting slurry with a density of 1400 to 1530 kg / m3. This composition, in terms of its strength characteristics and density, fully satisfies the requirements for cementing wells in the Ustyurt oil and gas region. The use of brown coal makes it possible to save oil well cement by 30 - 40% and bentonite clay up to 20%. The proposed composition of the lightweight grouting slurry based on brown coal has passed field tests during the cementing of a surface conductor, which was lowered to a depth of 910 m in borehole No. No. 2 North Berdakh. [3].

According to the project, the casing string with a diameter of 299 mm was to be run to a depth of 1600 m, and clean cement slurry was used to cement the well.

Taking into account the drilling conditions, it was decided to lower the surface to a depth of 910 m. The reason for this decision is to accompany the drilling process with partial losses of mud on sandy deposits and shedding of sea sand from the upper interval into the wellbore.

For cementing the casing, a lightweight grouting slurry with a specific gravity = 1.45 g / cm3 was used. The grouting slurry contains cement, brown coal, bentonite in a ratio of 3: 1: 1. [4.5]

According to the project, for cementing the column, it was envisaged to use a cement slurry prepared from 89.7 tons of oil well cement at W / C = 0.7. To prepare a lightweight grouting solution in the amount of 78.4 m3, the following was consumed:

- Cement - 50 tons.
- Brown coal - 15 tons.
- Bentonite 15 tons.

The use of the formulation of the lightweight grouting slurry during the cementing of the surface casing ensured the rise of the cement slurry behind the casing to the wellhead. The rise of the grouting slurry behind the casing was accompanied without absorption into layers, consisting of porous and fractured rocks, although when cementing with gel cement and mortars based on Portland cement. The losses of the cement slurry were observed; as a result, the cement slurry was not raised to the design height behind the casing.

Tests of the formulation of the lightweight grouting slurry on well No. 2 of the Severny Berdakh area showed that this composition provides high-quality cementing of the surface casing while saving grouting cement and prevents complications associated with the absorption of cement slurry.

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CAR- Carbon alkali reagent
NTMP- Nitrilotrimethylphosphonic acid (white powder)
FHLS- Ferrochromlignosulfonate
CMC - carboxymethyl cellulose
K-4 - polymer reagent
CETS - central engineering and technical service
DOD - drilling operations department
pH - pH, a measure of the acidity of aqueous solutions