Influence of Magnetic Field on Properties of Cement Compound on The Base of Boron-Containing LRW

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At present boron-containing LRW cementation is an actual objective. At traditional cementing the grout on the base of boron containing LRW does not only harden, but also even does not stiffen. To obtain a cement compound with satisfactory regulated properties, a number of additives, for example, alkali (to correct pH), hydroxide or calcium salts, alkali metal hydrosilicates are applied, which complicates technology and requires LRW chemical continuous composition control.

A method of boron containing LRW cementation with the use of a vortical apparatus (fig.1.) was developed at MosNPO "Radon". The vortical apparatus consists of an inductor with electric windings, which create a rotary electromagnetic field. There is a mixing chamber with ferromagnetic particles inside of the inductor. These ferromagnetic particles under action of electromagnetic field come into a chaotic motion and create and hence create a vortical layer. Treatment of materials in the vortical layer is one of methods to intensify a number of technological processes: mechanical mixing, electrolysis, extraction, etc.

Developed method is follows: LRW together with cement in quantity 10% - 30% of LRW weight are treated in the vortical apparatus during 10-30 seconds, further the mixture obtained is used to prepare grout at solution / cement ratio 0,5-0,8 with the help of traditional mixer (for example, a capacitative mixer with propeller stirrer).

Application of this method for cementation of boron-containing LRW with salinity 600 g/l (treatment of LRW + 30% of cement in the vortical apparatus during 15 seconds, solution / cement ratio of the final cement compound is 0,7) have made the cement stone strength for pressing on 28 day of hardening 15 MPa, leaching rate of Cs^{137} on 14 day testing - $1*10^{-3}$ g/cm^2*day.

Influence of electromagnetic treatment in a vortical layer on strength of cement compounds at W/C = 0,7 was investigated (table 1., fig.2.).

Vortical mixer.

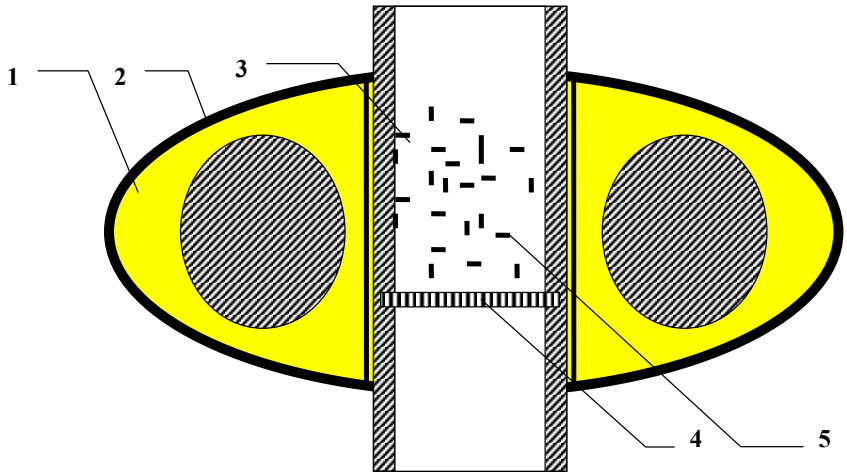

Fig.1.
1- inductor of vortical mixer;
2- windings of inductor;
3- cameras of the mixer;
4- ferromagnetic particles;
5- separating lattice.

For this purpose cement grouts on the base of boron-containing LRW were prepared by:

- intermixing manually during 3 minutes for a comparison;
- intermixing manually during 1 minute with consequent treatment in the vortical mixer with ferromagnetic particles, varying time of treatment.

From cement grouts we prepared samples and determined compression strength at various terms of hardening. Samples were stored under humid air conditions.

Table 1.

Influence of electromagnetic treatment in a vortical layer on strength of cement compounds at W/C = 0,7.

Time of intermixing in vortical mixer, sec.	**Compression strength, MPa/day**				
	7	**14**	**28**	**56**	**0,5 year**
Without treatment	-	-	-	-	-
10	-	-	-	-	-
30	-	4,3	12,0	14,9	18,9
60	4,3	11,7	14,7	18,7	23,3
180	14,9	15,9	15,1	15,6	30,2

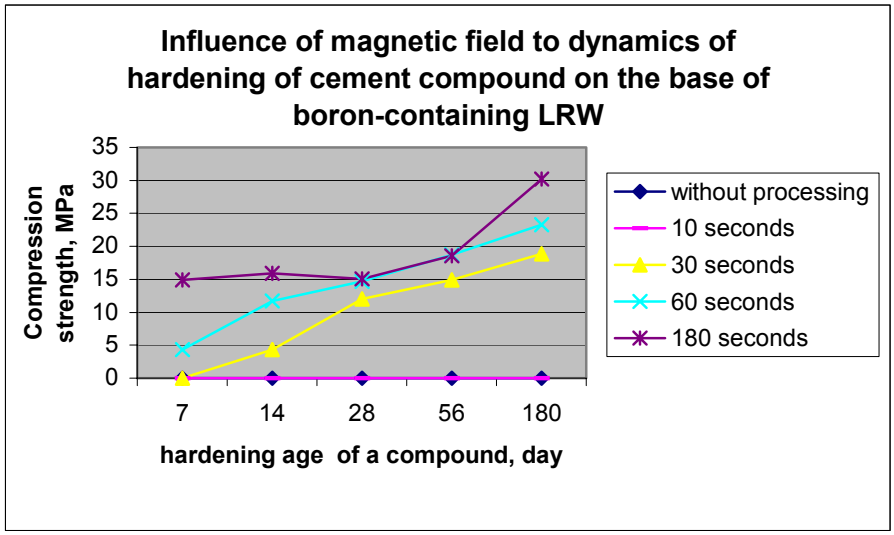

Fig.2.

For increasing a reliability of operation of plant an optimum mode of cement grout preparation at W/C = 0,7 with use of the vortical mixer was determined (table 2., fig3.).

For this purpose boron- containing LRW was mixed with a part of cement manually (20, 40, 50 % of all amount of cement) and the prepared mixture was treated in the vortical mixer with ferromagnetic particles during optimum time of 30 seconds.

Further on the base of this mixture a cement grout with the rest of cement was prepared. From cement grouts we prepared samples and determined compression strength at various terms of hardening. Samples stored under humid air conditions.

Table 2.

Influence of electromagnetic treatment in a vortical layer on strength of cement compounds at W/C = 0,7.

Cement quantity in preliminary mixture, % of total amount of cement at W/C=0,7	**Compression strength MPa/day**				
	7	**14**	**28**	**56**	**0,5 year**
30 %	-	-	-	-	-
40%	1,6	10,2	12,9	16,1	18,5
50%	0,8	5,0	11,9	11,2	19,7
100 % (standart,treatment of total grout)	-	4,3	12,0	14,9	18,9

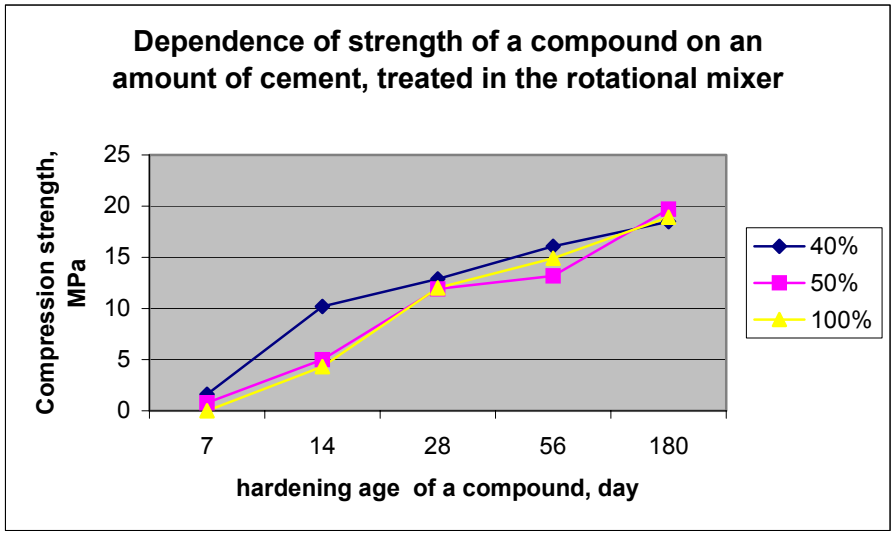

Fig.3.

Currently technological equipment for this method application in the LRW cementation installation is developed at MosNPO "Radon" (fig.4-5).

COMPACT COMPLEX FOR RADIOACTIVE WASTE CEMENTATION.

Fig.4.

COMPACT COMPLEX FOR RADIOACTIVE WASTE CEMENTATION

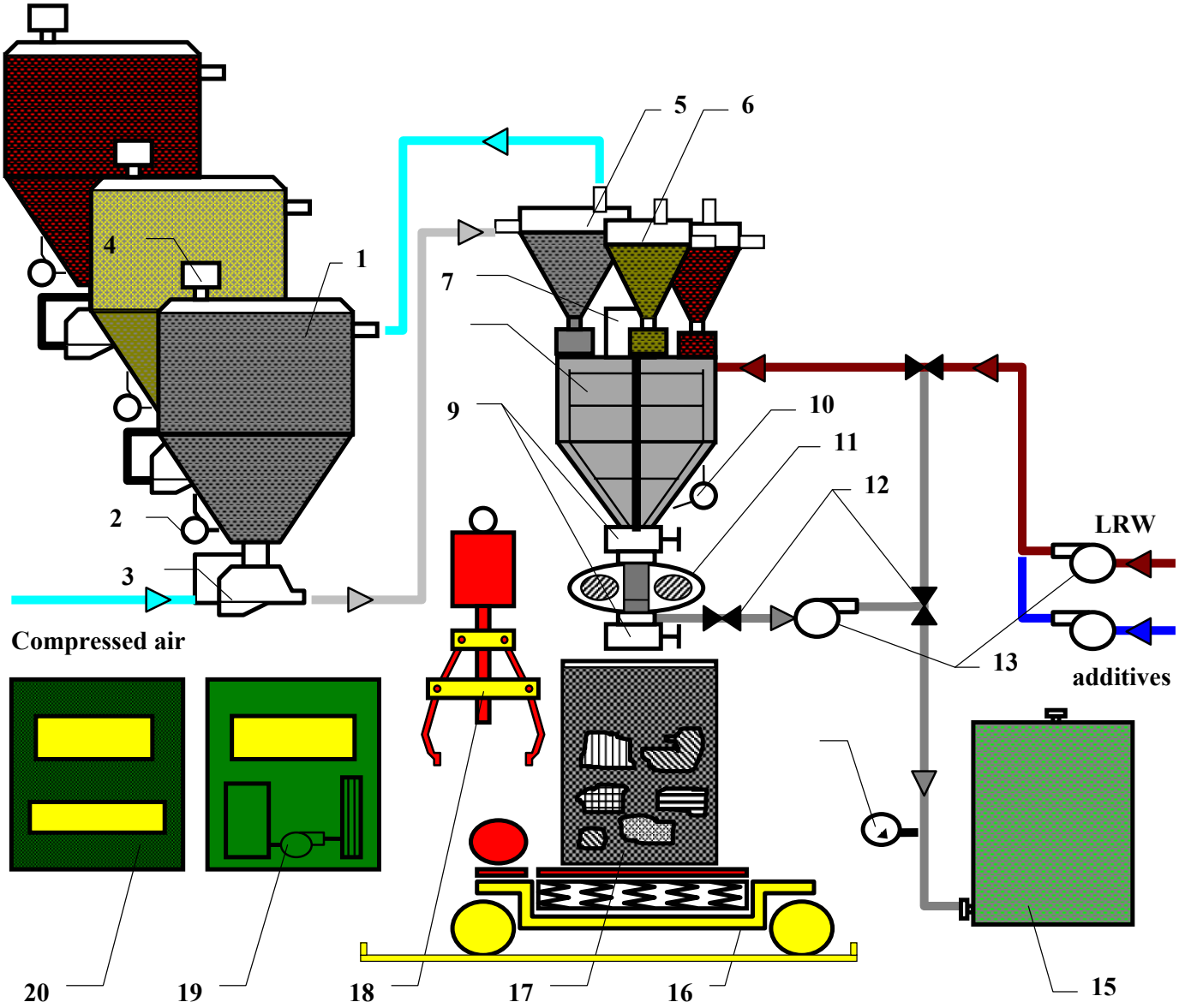

Fig. 5.

1-bunker for loose materials supply;
2-vibrator;
3-jet pump;
4-air vent;
5-cement supply bunker with batcher;
6-additives supply bunkers with batchers;
7-drive of stirrer;
8-vessel with stirrer;
9-hose locks;
10-vibrator;
11-vortical mixer;
12-electromagnetic valves;
13-pump-batcher;
14-manometer;
15- container for granulated sorbent;
16- self-propelled bogie with vibroarea;
17-container with SRW;
18-crane-capture;
19- unit for service of vortical mixer;
20-control panel.