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EVALUATION OF THERMAL AND THERMOCHEMICAL PROPERITES THE WELL BOTTOM ZONE

T. K. AKHMEDZHANOV and D. K. BAISEIT*

Institute of Geology and Oil Gas Business after K. Turysova, Kazakh National Technical University After Name of K. I. Satpayev, ALMATY (REPUBLIC OF KAZAKHSTAN)

ABSTRACT

The performance of oil and gas wells and absorption capacity of injection depend mainly on the permeability of rocks, pitting the reservoir. The permeability of rocks of the same layer can be dramatically altered in its different zones or areas. Sometimes when the general good permeability reservoir some wells reveal a zone of low permeability, resulting in deteriorating the flow of oil and gas to them. The natural permeability of the rocks under the influence of other reasons can also deteriorate over time.

Thus, the well completion drilling bottom-hole zone, they are often contaminated decay clay solution, which leads to clogged pores and reduce the natural reservoir permeability. With the exploitation of oil and gas wells in the permeability of the rock face zone can rapidly deteriorate due to the blockage of pores and the waxy resinous deposits, and clay particles. The permeability of rocks improve bottom-hole by artificially increasing the number and size of drainage channels, increased fracturing of rocks, as well as by removing the wax, tar and dirt deposited on the walls of the pore channels. Methods for increasing the permeability of the rock face zones of wells can be divided into chemical, mechanical, thermal, and physical. Often the best results, these methods are used in combination with each other or in series[1].

Key words: Bottomhole, thermochemical, permeability, oil and gas, carbonate rocks.

INTRODUCTION

The choice of method influence on the well bottom zone is determined by the reservoir conditions. Chemical methods influence to give good results in low permeable carbonate rocks. They are successfully used in cemented sandstones, which contain carbonate inclusions and carbonate cementations material. Mechanical treatment methods are usually used in beds composed of dense rock, with a view to increasing their fracture[3].

*Author for correspondence; E-mail: super_tayber@yahoo.com

The main objectives of the study, Effects of thermal methods used for the removal from the walls of the porous channels of wax and resins, as well as intensification of chemical processing techniques face zones. Physical methods designed to remove from the well bottom zone of residual water and solid fine particles, which ultimately increases the permeability of the rocks for oil. Thermal methods of influencing the bottom zone are used in the operation of wells in oils containing paraffin or resin. In the operation of such wells at low temperatures varies oil phase equilibria of its constituent components, decreases the solubility of wax and resin, and the last deposited at the bottom hole on the walls of wells and lifting pipes. As a result of blockage of pores deteriorates filtration capacity of the reservoir and the well productivity is reduced. At bottom zone heating paraffin-resin deposits in the pipes on the walls of wells in the area and the pores of the filter bed and makes melt flow of oil to the surface. This improves the filtering capacity of rocks in the bottom hole, reduces viscosity and increases the mobility of oil, which also facilitates the conditions for its progress in the formation. Bottom zone is heated by electric heaters and gas heaters, hot oil, petroleum products, water and steam, as well as by thermo-chemical stimulation.

EXPERIMENTAL

Thermal processing of the well bottom zone

In wells, reducing their productivity because of sediment in the bottom hole of paraffin or Asphaltic-resinous substances, acid treatment is more effective if the bottom hole preheat to melt these substances. So, the well pre-washed with hot oil or produce thermal processing. Thermal processing - the process of combination: the first phase, it is heat (thermochemical) processing the borehole hot solution of hydrochloric acid, in which the solution is heated by the thermal effect of the exothermic reaction between the acid and any substance, in the second phase of the thermal processing, the next with no break after the first, is the usual acid treatment[2].

There are many substances that come in an exothermic reaction with hydrochloric acid (caustic soda, calcium carbide, aluminum, etc.), but the best recognized magnesium as the reaction of acid with a large amount of heat, and the reaction products are completely dissolved.

The interaction of hydrochloric acid and aluminum, although it stands out more heat than the reaction with magnesium, foods in the form of a voluminous mass of aluminum hydroxide precipitate. Small amounts of aluminum, lead to strong sedimentation and clogging pores formation. The amount of heat released during the dissolution of magnesium in hydrochloric acid, determined from the equation (for one mole of Mg).

$$Mg + 2HC1 + 2H_2O = MgCl_2 + H_2O + H_2 + 4701 \text{ J}$$

From this equation it is clear that, when dissolved in acid, 1 mole of magnesium equal to 24 g in weight, 470 KJ of heat released, dissolving 1 Kg of magnesium in the amount of heat is 18.9 MJ. To dissolve 1 Kg of magnesium to 18.6 Liters of 15% hydrochloric acid. If that's the acid is converted into a neutral solution of magnesium chloride, which is heat (18.9 MJ) would be heated to a temperature of 308°C. However, such high temperatures would lead to negative events, i.e. the loss of heat to the steam generation with the release of magnesium chloride.

In addition, to melt the wax and resin need a much smaller temperature. Therefore, this ratio will be rational to magnesium acid to the final temperature of the solution after the reaction was within the range 75-80°C. The treatment of wells in the thermochemical and phase are to react with magnesium acid before entering into the layer had a temperature of about 75-80°C and at the same time would have been still quite active (10-12% concentration) to react with the rock formation. Empirically found the following quality indicators, resulting in the complete dissolution of magnesium in 15% strength acid[3].

Table 1.

Number of 15% strength residual concentration acid	Increase solution (°C)	Temperature acid (%)
50	120	9,6
60	100	10,5
70	85	11,0
80	75	11,4
100	60	12,2
120	50	12,7

Given that the temperature of the acid solution before the reaction is equal to 10-30°C, can be taken as the optimal ratio of 70 to 100 liters of 15% strength acid for 1 Kg of magnesium at the design temperature of the solution after the reaction from 75 to 90°C and the residual concentration of HCl, equal to 11-12.2%. In the calculation of acid injection regime is necessary to have data about how much time acid contact with magnesium will reduce it to a given concentration, for example with a 15% concentration to 11.0 or 12.2% strength. Obviously, the greater the amount of acid reacts with the same amount of magnesium, the more time is needed to reduce its concentration and, conversely, the greater the contact area between the acid and magnesium, the faster the reaction, rapidly reduced the concentration of acid[4].

Empirically found that 15% of 1-cm-term acid when exposed to 1 cm^2 of the surface of magnesium will reduce its concentration to 11.5% for 10 s, 2 cm in acid when exposed to the same surface concentrations decreased to 11.5% for 15 seconds and finally, 4 cm will reduce the acid concentration up to the set of 25. To carry out thermal processing magnesium in the form of bars or chips loaded into a special tip of the reaction, which descends to the tubing to the bottom hole.

From 40 to 100 Kg of magnesium, are pumped through the amount of hydrochloric acid. The upper pipe 3 through the tip is attached to the sub 2 coupling tubing. This tube (the barrel pin tip) filled with bars of magnesium, it is the reaction between magnesium and pumped through a pipe acidic solution. The lower tube is in which the top of the pipe through the plate-grid enters an acid solution, heated by the reaction with magnesium, is designed to eject the hot acid on the borehole wall through the nipple, Threaded holes in the pipe. These holes are arranged in pairs in a staggered manner at intervals of 0.5 m along the pipe. For degassing the hot solution flowing into the lower tube in the socket joint between the top and bottom of the funnel-tube set gas sampler. To remove the released gas (hydrogen) at the top of the pipe at the bottom of the MUF drilled four to six holes with a diameter of 3 mm in a single row around the circumference of the tube, the bottom of the bottom of the pipe is installed on the heels thermometer recorder to record the temperature during the process. For protection from the hot solution of the thermograph is placed in an iron casing[5].

The disadvantage of this construction the tip of the reaction is that to bring him to the face and back extraction wells must produce labor-intensive and lengthy salvage operation and the descent of the column tubing. Implementation of thermal processing wells without time-consuming operations up and down the tubing is possible with plug-reaction tip, lowered into the borehole to the sucker rods. Thermal processing wells in the following order. The tip load of magnesium rods and lowered to the lifting tubes or rods in the hole. After all the preparatory work in the oil pipe is pumped at a maximum feed pump. Immediately behind the oil without any interruption to the well pumped 15% hydrochloric acid solution at a rate calculated in accordance with the regime.

After the injection portion of acid, intended for the first (thermochemical) phase of treatment, the acid solution is injected for the final stage of processing. At the end of injection of the total acid solution is pumped into the borehole fluid and squeeze acid is forced into the formation. The rate of acid solution injection for the first stage of processing (thermochemical) is selected so that when passing the solution through the tip of its concentration would be reduced to a predetermined value, and the temperature would rise to 75-90°C. This is a necessary, although intractable condition. The difficulty is that the conditions that determine the interaction of acid and magnesium, when pumping it through the tip is continuously changing (mass, volume and surface area of reacting magnesium, the amount of reacting at any given acid, the ratio of its surface area, the temperature of the reaction medium and etc.). All this complicates the calculation mode of pumping acid. Therefore, the approximate mode of pumping acid through a tip from the magnesium particle in the time Meni, is determined on a special stand, and then adjusted according to the downhole recording thermograph with commercial arrangements. Thermochemical process can be combined not only with simple treatments, under pressure, but also with kislotostruinymi. To do this, use special tips with profiled nozzles.

RESULTS AND DISCUSSION

The method of thermochemical treatment of the CCD (Charge-Coupled Device)

Using in the oil industry, particularly in the thermochemical processing of bottom hole formation zone provides improved coverage of processing depth and thickness of the layer, as well as reducing corrosion of oilfield equipment and elimination of tripping. The inventive method of thermochemical treatment of bottomhole formation zone includes a heating layer zones. This is done by chemical reaction of an aqueous solution of hydrochloric acid and reagent material. As the reagent material is used an aqueous solution of diethylamine. In addition, in the bottom zone initially injected an aqueous solution of diethylamine, followed by injection of an aqueous solution of hydrochloric acid in a stoichiometric ratio, object of this invention is to increase the coverage of treatment in the depth and thickness of the layer, as well as reducing corrosion of oilfield equipment and elimination of tripping.

The aim is achieved by a method of thermochemical treatment of bottomhole formation zone, which includes warm-layer zones as a result of an exothermic chemical reaction of an aqueous solution of hydrochloric acid and reagent material in the material used as reagent water solution of diethylamine. In addition, in the bottom zone initially injected an aqueous solution of diethylamine, followed by injection of an aqueous solution of hydrochloric acid. To implement the method in field conditions using equipment normally used for the processing of bottom-hole zone. Determine the required volume of formation batyvaemoy face zone based on the capacitive characteristics of the collector. From the stoichiometric ratios for appropriate amounts of hydrochloric acid and diethylamine. Prior to the events at the mortar site or at the wellhead are preparing aqueous solutions of hydrochloric acid and diethylamine. Further, the well is pumped aqueous solution of diethylamine, which is forced into the formation an aqueous solution of hydrochloric acid. An aqueous solution of hydrochloric acid is forced into the layer of light oil or water. Uploaded solutions kept in the hole on the response, and then taken away from the well. The proposed invention is significantly different from the existing high coverage of processing depth and thickness of the layer[3].

The effect is achieved by increasing oil production. The method of thermochemical treatment of bottomhole formation zone, which consists in heating the bottomhole formation zone due to the exothermic chemical reaction, is pumped into the bottom zone flipper of an aqueous solution of hydrochloric acid and reagent material, characterized in that a reagent material in the bottom zone of the reservoir is pumped aqueous diegilamina[6].

Table 2.

No. Experience	**The length of the reservoir model, (m)**	**The dimensionless parameter, (R)**	
		The proposed method	**prototype**
1	0.5	1.32	1.30
2	1.0	1.63	1.25
3	1.5	1.8	1.20

The invention concerns to oil and gas extraction industry, in particular to arrangements, manufactured from solid propellant charges which during their ignition in a trunk of a chink carry out thermal gas chemical processing of a productive layer with objective of increase of an oil recovery and gas due to increase of filtration characteristics of rocks and clearing near-well zones of a layer from collected during the previous operation of a chink of asphalt-resin-paraffin adjournment, products of chemical reactions, sandy-argillaceous particles and T. Item.

The arrangement for thermo chemical gas processing of the productive layer, including lowered in a chink on a cable-cable and performed in the form of a continuous cylindrical checker with an igniter and with the central round channel open-frame a charge from solid fuel a material, namely from ballistite powder is known. For maintenance of stable burning into a material of a charge enter filler the stabilizer of burning.

The thermal effect of combustion products leads to melting of asphalt-resin-paraffin deposits and increase of chemical reactions, excitation arises in formation during combustion of gunpowder charge Physico-chemical action of combustion products reduces the viscosity and surface tension of oil on the border with water, partial dissolution of carbonate rocks and calcareous cement and around the well. However, this known device is not fully use the potential opportunity ion powder charge, and for this reason, efficiency of the known device is bounded. This is due to the fact that the fillers stabilized combustion analyzer Ballistite powder is introduced, as a rule, more than 1.5-2.0 by weight of the charge to ensure its stable combustion. Therefore, the burning of the famous gun charge thermo chemical gas effect manifests itself only in the immediate vicinity of the well (no more than 60-150 cm from the borehole) and does not extend to great depth reservoir[7].

In addition, the known device is the lack of reliability, since in many cases during combustion in a well powder charges are broken before the end of combustion because the combustion products of combustion of the charge did not have time to get out of the central circular channel, increasing the pressure in it. When the pressure in the channel exceeds the amount of pressure around the charge the channel is broken. The aim of the present invention is to increase the efficiency of the device by providing for its work to increase the depth of processing of the reservoir through the creation of vibration and / or pulsed mode of combustion of the charge for simultaneously improving the operational reliability of the device[5].

The goal is achieved in that in the known device for the treatment of thermo chemical gas reservoir, which includes lowered into the borehole on a cable-rope, and made in the form of a solid cylindrical pieces with the igniter, and a central circular channel open-frame charge of solid material, such as ballistite gunpowder-filled- stabilization of combustion, the ratio of the length of the central circular channel charge and diameter equal to the specified channel is satisfied. and perpendicular to the central circular channel in the body along the length of the charge carried an additional series of cross-cutting channels with diameters of 0.25 to 1.0 diameter central circular channel at the same time in a row fulfilled through channels cross intersecting at right angles to each other, the distance along the length of the charge between any two adjacent rows of cross-cutting channels made equal. It was found that, if the filler content in stabilizer in the powder charge will be made no more than 0.6 by weight of the charge, then the stable regime is completely eliminated its combustion. The burning of the charge will be vibrating and / or pulsating, resulting in the cavity center general of the round channel devices are pressure fluctuations.

Due to the fact that the claimed device was proposed perpendicular to the central circular channel in the body of the charge along the length of the additional rows to perform cross-intersecting at right angles to each other through channels, provided the transfer to the fullest extent of all occurring during combustion of the charge of energy from the central cavity channel through the ranks of the transverse cross-cutting channels in all directions deep into the treated layer over the entire height of the charge. In addition, through these transverse channels in the body is provided free of charge and timely product yield of rhenium-from the cavity of the central circular channel that prevents the rupture of the body of the charge during the time of its burning[2].

At the same time, it was surprisingly found that the ratio of the length of the central circular channel charge and the diameter of this channel should be made equal to (40, 120) 1, the distance between any two adjacent rows of cross-cutting channels along the length of the charge must be made equal to (20 - 40) 1 the length of the central circular channel to its diameter and the diameter of through-channels should be made equal to 0.25 1.0 diameter of the central circular channel. Only with this proposed ratio of the size of the elements of this device in conjunction with the introduction of the stabilizer is not burning more than 0.6 by weight of the charge, the opportunity is also created to strengthen the central charge circular channel vibration and / or pulsating pressure variations.

Increasing the distance between the rows of cross-cutting channels above these limits will lead to the products of combustion will not have time to go round from the central channel and the pressure in the cavity of the channel increases to a value greater than the pressure in the environment, resulting in pressure drop due to charge will be torn, not having to burn. A reduction in the length of the central circular channel does not provide pressure oscillations in the cavity of the channel due to strong boundary effects, which lead to energy loss through the ends of the charge.

CONCLUSION

Thus, due to the proposed combination of essential features, the proposed device for the treatment of thermochemical gas reservoir than the mechanical, thermal, physico-chemical effects, and provides an additional wave (high frequency and / or low frequency) effect on the reservoir by providing a vibration and / or pulsed modes combustion of the charge, while increasing the operational reliability of the device, i.e., excluding the charge gap during its combustion.

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