EFFECT OF THE INFLUENCE OF MAGNETIC FIELD ON THE ASPHALT - RESIN - PARAFFIN DEPOSITS

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This paper presents an overview of some of the study on the influence of magnetic field on the prevention of asphaltene-resin-paraffin deposits in oil.

Currently, the development of the oil industry due to the significant complications in the development of oil fields. The processes of extraction, gathering and treatment of oil, complicated by the complex of problems connected with asphalt-resin-paraffin deposits (ARPD) and salt Deposit, corrosion destruction of the equipment, the formation of stable oil emulsions and other The most acute problem of control ARPD and on the fields of Kazakhstan with the extraction of petroleum and purifieth oil in particular, on the Uzen, Zhetybai and the number of fields in the South Turgai SAG face difficulties while dealing with this type of deposits

Keywords: development of oil fields, asphaltenes, waxes, resins, deposits, complications, asphalt-resin-paraffin, magnetic field

ВОЗДЕЙСТВИЕ МАГНИТНОГО ПОЛЯ НА АСФАЛЬТО- СМОЛО- ПАРАФИНОВЫЕ ОТЛОЖЕНИЯ

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В настоящей статье приведен обзор ряда исследовании по воздействию магнитного поля на предупреждение образования асфальто-смоло-парафиновых отложений в нефти.

В настоящее время развитие нефтяной промышленности обусловлено значительными осложнениями при разработке нефтяных месторождений. Процессы добычи, сбора и подготовки нефти, осложняются комплексом проблем, связанных с асфальто-смоло-парафиновыми отложениями (АСПО) и солеотложениями, коррозионным разрушением оборудования, образованием стойких нефтяных эмульсий и др. Наиболее остро стоит проблема борьбы с АСПО и на месторождениях РК с добычей высокопарафинистых и парафиистых нефтей в частности, на месторождениях Узень, Жетыбай и ряда

месторождений Южно-Тургайского прогиба сталкиваются с трудностями именно при борьбе с таким видом отложений.

Ключевые слова: разработка нефтяных месторождений, асфальтены, парафины, смолы, осложнения, асфальто-смоло-парафиновые отложения, магнитное поле

The problem on influencing of constant magnetic fields on well production is now one of the most interesting, capable to lead to magnification of an overhaul period of wells. At the same time this method is debatable, leading to ambiguous and contradictory effects. In many cases the nature of such affecting is not adequately investigated. More often, according to some researchers, the effect while intensity of affecting, proceeding from physical reasons, is apparently insufficient for production of any useful effect. It belongs to magnetic phylum of affecting on the basis of which the principle of security is laid. This principle consists of jump in 1000-100000 times increases of an amount of nuclei of lampwaxes at the expense of operating of constant magnetic fields of certain topology and strength on natural aggregates of trace contaminants - rod-like minerals of IRON oxides/FERRIC HYDROXIDES, located in a current of water gas-oil production of wells. Increase of an amount of centers of crystallization leads to reduction of centre of crystallization ARPS in an appropriate number of times, and also to multiple (on some orders) decrease of absorption rate of chips on walls of pump-compressor tubes (PCT) as crushing of aggregates results in building in bulk of fluid adsorbing surface the floor space 30-100 m2/t [1].

The great number of monographs, browses, papers in which the emphasis is laid, first of all, on practical usefulness of application of magnet processing (MP) is published during the last years, numerous conferences and conferences on practice of application MP in a wide range of industrial productions have taken place. The amount of printed works and patents on these subjects is calculated now by thousand, and even tens of thousands. A major role in keeping the interest in this direction have been played by professor V.I.Klassen and the academician. V.Derjagin and leading scientific employee Institute of Oil and Gaz problems (IOGP) V.I.Lesin .

Simplicity of the procedure, consisting that the fluid flow flows past through a spacing between magnet poles or through the solenoid coil fed with an electric current, stimulated carrying out of the experimental works on a wide range of objects. Therefore the subsequent years MP was applied not only to water solutions of salts, but also for oil, engine fuels, solutions of polymers, cement and drill fluids, seeds of plants, a blood etc. By application MP eliminated salification of soils at their watering with a high salt content, prevented depositions of minerals and organic matters at extraction and water and oil haul, reached the considerable drop of viscosity of cement mortals etc. Wide application MP has got in medicine for meliorating of a status of veins, sanitation of a blood of poison gases, depressing of arterial stress.

However already in first years it was marked that effects are not always retried even for outwardly similar objects and processes. Surprising was the fact of operating of applied magnetic fields with strength some hundreds oersted on nonsensitive to such kind of fields nonferromagnetic substances - water, oil, blood, tissues of animals and plants. All these has led to formation of two polar opinions in relation to magnetic effects: the first is a charlatanism and effect of "dirty" experiment, second – on the basis of magnetic treating fundamental properties of substances are put which are still obscure in the physics. The scientific community was divided on enthusiasts who continued to research effects of MP and sceptics who did not take seriously the next messages on successful usage of MP.

Recently concern to usage of a magnetic field for processing of well fluid for the purpose of avoidance ARPS has considerably increased that is connected with appearance in the market of wide assortment of high energy magnets on the basis of rare-earth stuffs. Now about 30 various organizations offer magnetic dewaxing units [2, 3, 4-11].

As research works on processing magnetic field of well production are rare and not systematised, there are various theories in this field. For example, in V.I.Klassena's monography [12] following hypotheses are pointed out:

- "Colloidal" in the basis of which underlie impact of magnetic fields on colloidal particles more often a para- or ferromagnetic lies;
- "Ionic" on the basis of which the dominant role is given to the ions which are in water;
- "Aqueous", substantiating impact of magnetic fields on characteristics of water.

In effect, the enumerated hypotheses of the gear of operating of magnetic processing on aqueous systems are reduced to variation of connections of trace contaminants with fluid medium moleculas. Iron trace contaminants stipulate also high performance of magnetic treating the waters comprehensively researched and substantiated in the theory of V.I.Lesina [13] which is finally included into the number of the "colloidal" hypotheses, including impact of a magnetic field on the ferromagnetic fragments. On the basis of the above-stated theory at the presence of iron trace contaminants in well production processing of produced fluid by a magnetic field should be also effective.

It was found [6] that under the influence of a magnetic field in moving fluid there is a collapse of the aggregates consisting of submicronic ferromagnetic microparticles of joints of iron, being at concentration 10 - 100 g/t in oil and passing water. Each aggregate contains several hundreds to some thousand microparticles, therefore collapse of aggregates results in sharp (in 100 - 1000 times) to magnification of concentration of nuclei of lampwaxes and salts and forming at surfaces of the ferromagnetic fragments of blisters of gas of the micron sizes. As a result of collapse of aggregates lampwax chips settle out in the form of fine-grained, volume, stable cloud, and growth rate of depositions is moderated proportionally to reduction of the centre sizes settled out jointly with resins and

asphaltenes in a solid phase of chips of lampwax. Formation of micro gas blisters in nuclei after magnetic treating ensures, according to some explorers, the gas-lift effect which leads to some growth of a rate of yield of holes.

The greatest application have devices on the basis of permanent magnets h "Magniflo" (USA), devices of the magnet processing of liquids (MPL) of the Research-and-production corporation «Technological systems» and some others. Designly they include one, two, three pairs of the permanent magnets arranged in a corps. In a spacing between two poles of magnets fluid is flowing. Taking into account experience of operation of these installations they should meet following demands [14]:

- Geometrically to be inscribed in a construction of glubinno-pump installation and not to create major hydraulic resistance;
- to ensure stable treating by a passing well of production by a magnetic field with length of 20-40 ka/m, within not less than 2-3 years;
- Magnets must be trusty locked and advocated from aggressive affecting of mined production.

Taking into account the introduced demands under the direction of the author of the work [14] production of plutonic well installations of magnetic treating of fluid of phylum installation for magnet processing of liquids (IMPL) is designed and mastered. The main distinctiveness is possibility of building of a pulsing magnetic field.

Well installations IMPL have been implanted in Joint-stock Oil company (JSOC) "Bashneft", JSOC "Белкамнефть", OC "Lukoil", OC "YUKOS", JSOC "Gazprom" and a number of other organisations. Application of installations УМЖ-73 has allowed to augment the centre overhaul life of wells Oil and Gas Extracting Administration (OGEA) of "Arlanneft" complicated on ARPS, on the average in 1,8 times, by this chemical treatment has been stopped.

However in practice of application of magnets for concrete petrocrafts there are numerous cases when magnetic treating of oil does not give positive results. Available defections to a certain extent discredited a process engineering of magnetic treating in the opinion of oil industry workers. As a matter of fact, a problem handicapping wide usage of magnetic treating is lack of the theory explaining the nature of originating processes, namely, the physicochemical gears of operating of a magnetic field on an oil current . Owing to it, requirements at which one the magnetic field hinders to formation of firm ARPS, remained until recently vague.

The situation was changed after in V.I.Lesina's work [6,15-18] the theory of magnetic treating of oil has been stated. It has been demonstrated that interplay of a magnetic field with a fluid current result in to collapse of aggregates of the ferromagnetic fragments of iron. At collapse of aggregates on separate fragments and pieces of the smaller sizes originates multiple (approximately in 100 times and more) increase of an amount of nuclei of lampwaxes. As it is positioned, natural trace

contaminants of such aggregates (in concentration 10-100 г/т), derivated rod-like minerals of IRON oxides/FERRIC HYDROXIDES in the characteristic sizes 0.5x0.05x0.05 really are present a micron practically at all naphthas containing resins and asphaltenes. Increase of an amount of nuclei result in reduction of centre bulks of chips ARPS. Shallow crystals remain weighed in a fluid flow that gives multiple (for several times) reduction of rate of upbuilding of crystals on the walls PCT.

In Kazakhstan similar works [19] also have been conducted. The Brief experience of application magnetic dewaxing units on the Kumkolsky field has demonstrated possibility of an effective utilisation of a magnetic field for strife with ARPS on wells of South Turgajsky bunch of fields. It is experimentally affirmed that the oil treated by a magnetic field gains "washing" properties, flushing away from equipment walls already derivated ARPS. Also by hot-oil of wells with affecting the process engineering of treating has been designed and recommended for working substance a constant magnetic field OGEA joint-stock company «PetroKazahstan Kumkol Resorsiz». On the wall АК-105 of a field of Aryskum after installation magnetic dewaxing units the interclearing season was augmented twice [19].

From the aforesaid in our opinion the most productive theory explaining processes of affecting of a magnetic field on ARPS is V.I.Lesina's theory according to which one aggregates of monoxides and the ferric hydroxides, present at tabular fluids, under the influence of a constant magnetic field are dissociated on the smallest fragments increasing number of centres of cristalisation of ARPS in ten thousand times, and derivated shallow chips are carried away by a fluid flow.

Thus, the expediency and perceptiveness of application of magnetic processing is affirmed by positive experience of its usage and propagation in various regions not only in Russia [20-23] but also behind its borders.

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