technological conditions of the process, and to determine the degree of catalyst deactivation depending on the volume of processed raw materials.

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ALGORITHM OF CALCULATING THE DIMENSIONS OF FRACTURES DUE TO HYDRAULIC FRACTURING IN SEDIMENTARY ROCKS

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The exploitation of an oil deposit consists in bringing the hydrocarbons to the surface by natural depletion under the best conditions. As soon as production becomes insufficient despite large reserves in place, new recovery techniques are introduced to improve productivity and the characteristics of well, one of these techniques is known as acid fracturing.

This technique artificially creates permeable drains by injecting treatment fluid which is acid (HCl) into the reservoir. The study of the injection of an acidic solution (HCl) in a porous medium is therefore of capital interest the aim of which is to predict the formation or not of wormholes, their size, the modification of the resulting permeability as well as the role of the different parameters on the final result. [2]

The success of such an operation depends very much on the parameters chosen and the decisions made in order to avoid any failure or any additional expense and have a good return on the operation.

The aim of our paper is to study the operation of acid fracturing in carbonate rocks and write an algorithm which calculates the main key parameters which indicate the success or failure of the process.

Carbonate rocks:

Represent all the sedimentary rocks which contain a large amount of carbonate minerals during their formation, among these the two main ones are calcite and dolomite, although their intermediates also exist (dolomitic limestone, limestone dolomite). [2]

Like sandstone, carbonate rocks are sedimentary rocks. The vast majority of these sediments are composed of the skeletons of marine organisms. Over time, carbonate sediments are subject to physical and chemical modification in order to reach a stable form such as calcite, limestone, the most abundant carbonate, when the sediment remains in contact with a fluid containing a lot of magnesium for a long time, it forms dolomite (CaMg (CO3) 2). [3]

Definition and Meaning of the damage:

The damage represents all the incrustations, whether mineral or organic, which can alter the natural permeability by their deposition inside the tank or by sealing the perforations or even the production tubing. This damage can be located in the different parts of the effluent path, from the tank to the surface. [1].

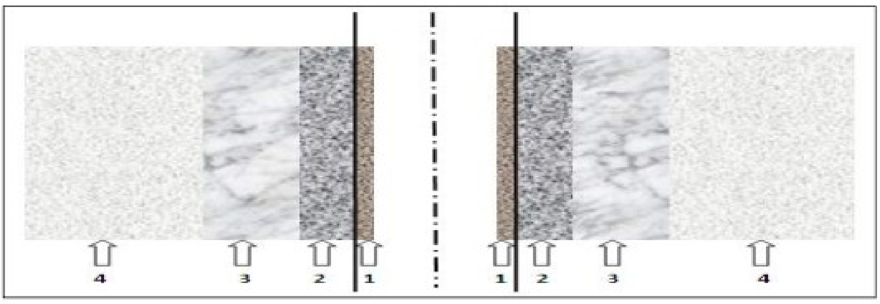

Fig.1 Location of damage

Zone 1: external cake will cover the walls of the well;
Zone 2: internal cake: solids having penetrated into the porous medium;
Zone 3: zone invaded by the mud filtrate;
Zone 4: virgin zone where permeability is not affected.

The skin effect:

The skin has several origins, the most important of which are:

• The inclination of the well: The inclination of the well improves the flows to the around the well, it contributes to a negative skin. [4]

• Hydraulic fracturing: Hydraulic fracturing improves considerably the flows around the well, it leads to a negative skin.

• Global damage: In all cases, additional pressure losses, located near the well (matrix), can be treated like a skin.

So the skin that will be measured during a test, is a result of all these skins. [2]

$$S = Se + Sp + Sc \quad (2)$$

Se: the actual damage around the well (matrix).
Sp: pressure drop due to perforations;
Sc: the constriction of the flow due to partial penetration.

The radius **rs** and the permeability ks of the damaged area are linked to the skin by the expression of HAWKINS:

$$S = \left(\frac{K}{Ks} - 1\right) ln\ \frac{rs}{rw} \quad (2)$$

S: skin.
K: permeability of the reservoir.
Ks: permeability of the damaged area.
rs: radius of the damaged area.
rw: radius of the well.

Stimulation by acid fracturing:

The acid fraction is a simulation technique in which a fluid (a viscous fluid pad) is injected into a carbonate formation at pressures higher than the fracturing pressures to create a fracture or open existing natural fractures. Once the fracture is created, acid is injected into the fracture, which reacts and dissolves the formation materials on the walls of the fracture. [4]

Klerk KGD Model:

• The equation for predicting the length of the fracture:

$$x_f = 0.539\left(\frac{q^3 E\prime}{\mu h_f^3}\right)^{1/6} t^{2/3} \quad (3)$$

• The equation for predicting the average width of the fracture:

$$\overline{w} = 1.91\left(\frac{\mu q^3}{E\prime h_f^3}\right)^{1/6} t^{1/3} \quad (4)$$

• The equation for the prediction of the net pressure in the fracture:

$$p_n = 1.09(\mu E'^2)^{1/2} t^{1/3} \quad (5)$$

```
#Conductivity (volumetric method) #
X1=0.082
X2= 0.071
X=[X1 X X2 X2] ;
Q=0.04
H=[114.84   150.96   187.01   209.97] ;
L=[242.78   219.82   183.73   173.88] ;
q=[17.2   17.4   19.5   19.7] ;
t=[4.76   7.33   7.33   7.33]
Wa=(67.4 * X. * q. * t.)./(2.*L.*H.*(1-Q)
Kfw = 7.84*10^12*(Wa./12).^3
```

Figure 2. Conductivity Calculation Algorithm

```
#geometry (KGD model)#
v= 0.15 ;
E2=9300000/(1-v) ;
q= 20
u=[0.239   66.39    66.39   66.39] ;
hf=[131.23   170.6   200.13   219.82] ;
t= [4.46   7.33   7.43   7.33] ;
Xf1=0.539*((q^3*E2)./(u.*Hf.^3)).^(1/3).*t.^(2/3) ;
Xf=sum(Xf1) #lenght#
Wb1=1.8526.*((u.q^3)/(E2.Hf.^3))^(1/6).*t.^(1/3) ;
Wb=sum(Wb1)# average width #
Pn1=1.09.*(u.*E2^2).^(1/3).*t.^(-1/3) ;
```

Figure 3. Geometry calculation algorithm

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