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MECHANICAL ANALYSIS OF VISCOUS-ELASTIC FLUID ACTING ON LINGERING OIL IN THE MICRO PORE

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ABSTRACT

This paper with a specific end goal to dissect the typical deviatoric stretch that thick versatile liquid following up on the remaining oil under the circumstance of distinctive flooding conditions and diverse permeabilities, Viscous-flexible liquid stream condition is set up in the smaller scale pore by picking the progression condition, movement condition and the upper-convected Maxwell constitutive condition, the stream field is figured by utilizing numerical examination, the powers that driving liquid following up on the lingering oil in smaller scale pore are got, and the impact of flooding conditions, pore width and gooey versatility of driving liquid on compel is thought about what's more, broke down. The outcomes demonstrate that: the more thick flexibility of driving liquid builds, the more noteworthy the typical deviatoric push following up on the remaining oil expands; utilizing steady weight slope flooding, the ale the pore width is, the more prominent ordinary deviatoric push following up on the lingering oil will be.

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INTRODUCTION

In the improved oil recuperation, the thick flexible liquid flooding is an essential part. Numerous researchers have attempted a great deal of endeavors on thick versatile liquid upgrading oil recuperation. By trial thinks about Wang Demin (Wang, 2000), discovered that gooey versatile polymer arrangement can move forward flooding productivity in miniaturized scale pore; Yin Hongjun (Yin, 2006), considered that the rheology of gooey flexible polymer arrangement in the deadlock: Xia Huifen (Xia, 2001), talked about the tiny instrument of gooey versatile polymer arrangement enhancing flooding productivity. In the paper, the power of gooey versatile liquid following up on remaining oil is dissected hypothetically under various flooding conditions, unique permeabilities, which establishes the framework for further examination of twisting.

Computation Model: With a specific end goal to break down the power following up on leftover oil in smaller scale pore of various width, a figuring model is set up appeared in Figure 1, Where H is the pore width, takes 20 μm, 40 μm, 60 μm separately. The center is oil wet. The film stature is 10 μm, the length is 40 μm. The limit conditions are setted: The channel and an outlet, separately, utilize a consistent speed ($1e-5\ m/s$), steady stream rate ($2e-10\ m^3/s$) and consistent weight inclination ($0.02\ MPa/m$). The limits meet the no-slip condition and expect that the film is stationary.

Fundamental Equations: Gooey versatile liquids have complex rheological properties. In view of test explore, the upper-convected Maxwell constitutive condition is reasonable to portray the rheological properties of gooey versatile liquid. The comparing congruity condition, movement condition also, constitutive condition (Han, 2002) are:

Congruity condition:

$$\nabla . u = 0 \qquad \text{...(1)}$$

where: u is speed vector.

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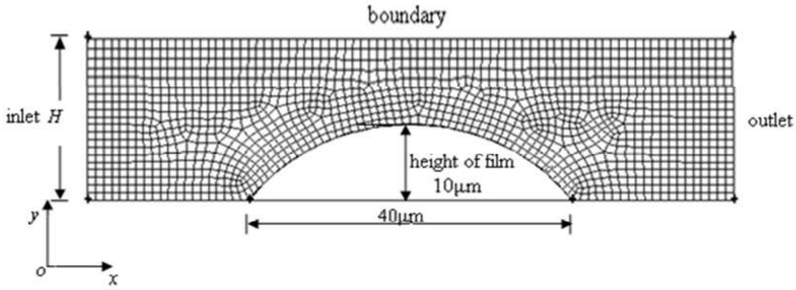
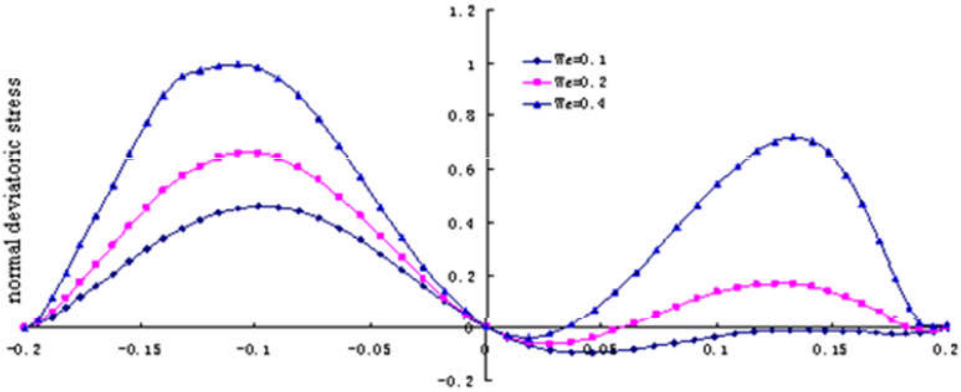
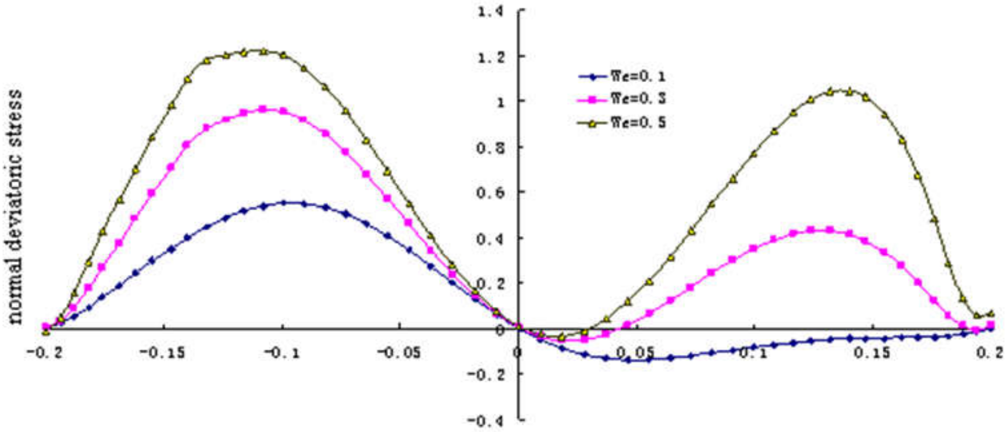


Figure 1. Estimation demonstrate



(a)



(b)

Figure 2. Typical deviatoric stretch following up on the deposit oil by thick versatile liquid of various We (weight is certain,t ension is negative); (a) Constant speed (steady stream rate); (b) Constant weight inclination

Force condition:

$$du/_{dt} = F + divP/_{\rho} \quad \text{……………………..(2)}$$

where: F is mass power; ρ is thickness; P is push tensor.

$$P = -pI + T \quad \text{………………(3)}$$

where I is unit tensor; $-p$ is static weight; T is deviatoric push tensor.

Constitutive condition:

$$T + \lambda \overset{\nabla}{T} = \eta A_1 \quad \text{………………………(4)}$$

where: λ is unwinding time, which is the portrayal of liquid versatility; η is shearing thickness; A_1 is one request Rivlin-Ericksen tensor.

ESTIMATION RESULTS

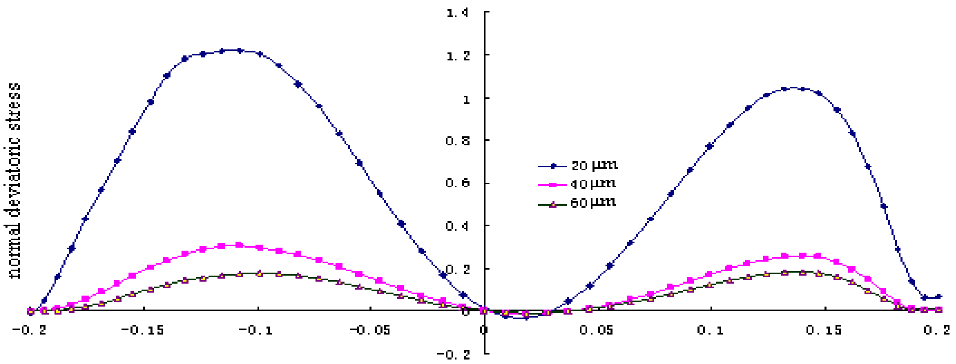
The Weissenberger number is a dimensionless amount which is utilized to depict liquid flexibility. The more prominent its esteem is, the more grounded the liquid flexibility is. The equation is:

$$We = \lambda v/_{l}$$

where We is the Weissenberger number; v is trademark speed; l is trademark length.

The Change of Normal Deviatoric Stress

Following up on Residual Oil under Different Flooding Conditions For a similar pore width (20 μm, for instance), utilizing consistent speed ($1e-5\ m/s$), steady stream rate ($2e-10m^3/s$) and consistent weight angle ($0.02\ MPa/m$), separately. The typical deviatoric push following up on the deposit oil is figured by various thick flexible liquid. As is appeared in Figure 2, for a similar pore width, the states of consistent speed and steady stream rate are the same. It can be seen from Figure 2, regardless of which of the states of steady speed, consistent stream rate or consistent weight inclination, the typical deviatoric stretch increments as We increments.



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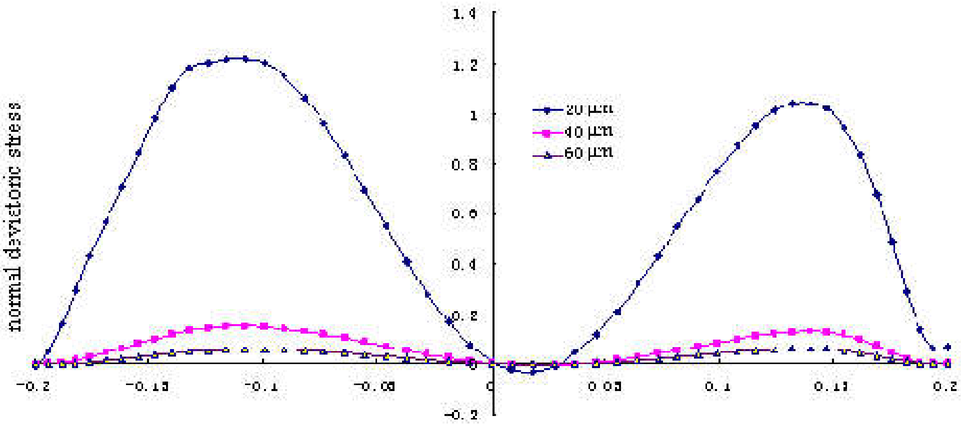

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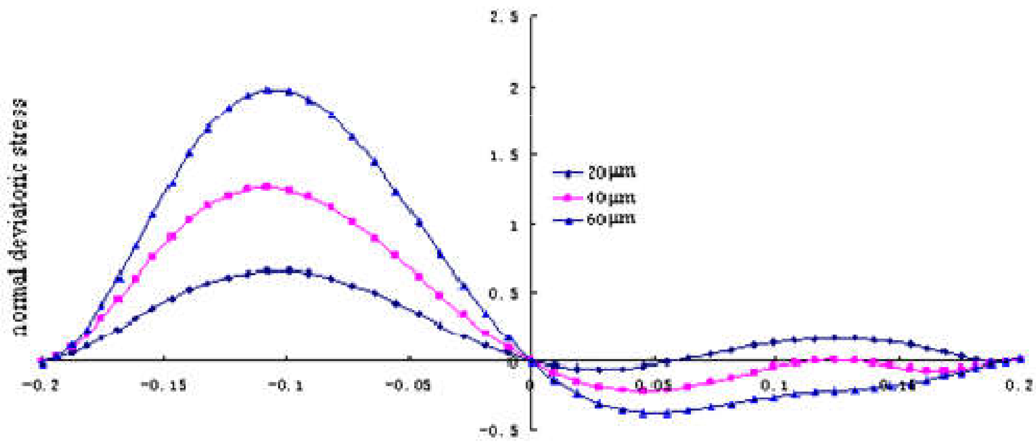

(c)

Figure 3. The typical deviatoric push following up on the leftover oil under various penetrability miniaturized scale pores (weight is sure, t ension is negative); (a) Constant speed (We = 0.2); (b) Constant stream (We = 0.2); (c) Constant weight angle (We = 0.2)

Which demonstrates that the more thick versatility of gooey flexible liquid is, the more greater typical deviatoric push is.

The Change of the Normal Deviatoric Stress Following up on Residual Oil under Different Porousness Micro Pores: For a similar We, miniaturized scale pores of 20 μm 40 μm and 60 μm separately, the powers following up on leftover oil under the flooding states of steady speed $(1e-5\,m/s)$, steady stream rate$(2e-10\,m^3/s)$ and consistent weight slope $(0.02\,MPa/m)$, are ascertained, which is appeared in Figure 3. It can be seen from Figure 3, when flooding with steady weight angle, with the expansion of the pore width, the typical deviatoric push increments. Despite what might be expected, when flooding with consistent stream rate and steady speed, the ordinary deviatoric push diminishes with the pore width increments. Flooding with weight slope in the oilfield, the high porousness zone bolsters more drive, remaining oil misshapes more prominent generally and is more powerless to be dislodged.

Conclusion

Utilizing consistent weight inclination flooding, the more noteworthy the penetrability is, the more prominent the power of remaining oil acting by thick versatile liquid is; utilizing consistent stream rate or consistent speed flooding, the circumstance is the polar opposite; as We expands, the power of thick versatile liquid following up on remaining oil increments.

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