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Extended Abstract

Investigating the creep behavior of some gypsum and anhydrite rock salt samples from Gachsaran Formation under cap rock temperature conditions

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Creep equation

Abstract

It is very important to investigate the creep behavior of sulfate bearing cap rocks such as Gachsaran Fm. of member 1 in wellbores. Since the cap rock was not cored in oil wells, block samples was gathered from the surface outcrops of cap rock and then cored in the laboratory. In the next, the UCS tests were performed on cores to determine the amount of initial load for multi-stage creep tests. Afterwards, based on UCS and the temperature of the common cap rocks, creep tests were performed at two temperature conditions of laboratory and cap rock environment. Based on the creep tests data, the exponential and Power law fitting creep equations performed on samples. The results showed the creep yield stress of 12 MPa and 20 MPa for gypsum and anhydrite respectively. Also, the Linear Viscose Limit for creeping of gypsum and anhydrite was obtained in bounds of 5.5 to 6.7 MPa and 9.8 to 15.15 MPa respectively. In addition, creep tests on gypsum under temperature shows more plasticity and uniformity in its creep behavior. Also, the threshold of accelerated creep in anhydrite is lowered and its total creep time is reducing under temperature.

1. Introduction

Nowadays A lot of problems such as wellbore closure and well clogging are happening due to the creeping and failing of wellbores. The gypsum and anhydrite are the very abundant and usual sulfates which are less investigated and regarded as soft rocks accompanying mudstone, marl and shales. The strength of gypsum and anhydrite ranges between 5 to 25 MPa [2,3]. Bell investigated on geotechnical properties of evaporitic rocks such as sulfates, halite and potash in some American mines [4,5]. There exists massive gypsums in the some evaporitic basins around the Mediterranean sea, named as Alabastrine Gypsum with strength rage of 18 to 36 MPa that their prehistoric age is equivalent to Gachsaran evaporitic formation in southwest of Iran [6,7]. The Gachsaran Formation is an important sealing cap rock on top of oil reservoirs in SW of Iran and Iraq [8-11] and contain seven members which have creep potantial completely [1,11,12].

2. Methodology

All of the compressive creep tests are performing in the following three stress states: First is the Constant Stress State that the axial loading on core samples, is kept constant and the axial and lateral strains are measured during the test until creep failure. The second type of creep test in rock mechanics is the Constant Strain Rate creep test. This creep test sets the stress dynamically variable so that the stability of strain rate could be preserved. The third type of creep test is the Relaxation Creep in which the closure of experimental samples in primary creep was investigated and devoted to evaporitic rocks. Our tests conducted as the multi-step loading on the samples which have an advantage as in this state the yielding behavior of prestressed rocks around wells could be modeled after drilling.

The gypsum and anhydrite blocks were collected from Gachsaran formation in order to UCS and creep experiments. The coring process was very overwhelming because of solubility of blocks and

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finally 14 samples cored using high saline soup drilling water. Then the 8 and 6 cores used for uniaxial strength determination and creep test respectively. Among the 6 creep tests, just the 4 tests finished successfully. The first creep test for each other samples of gypsum and anhydrite confirmed in laboratorial temperature and the second tests were confirmed in cap rock temperature conditions inferred from the research texts (fig 1 & 2).

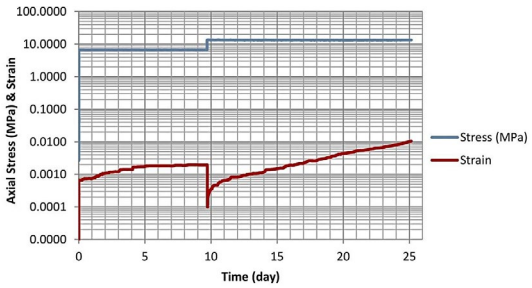

Fig. 1. Stress and Strain-time plot for secondary creep test of gypsum under cap rock temperature condition.

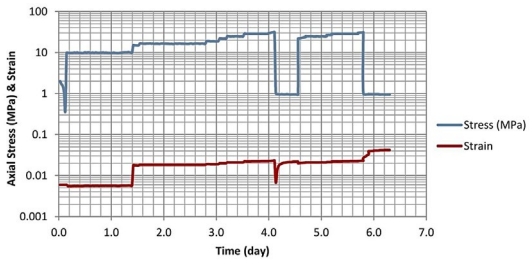

Fig. 2. Stress and Strain-time plot for secondary creep test of anhydrite under cap rock temperature condition.

3. Results and Conclusions

Curve fitting showed that because of dissociation in creep data, none of power law and exponential curves can't predict the trend of total triple creep stages, but they could be helpful for predicting the secondary creep stage curve and its behavior. After the creep tests the linear viscose limit (LVL) and the transition creep stress were determined for gypsum and anhydrite using the regression curves. The LVL for gypsum and anhydrite were determined 5.5 to 6.7 MPa and 9.8 to 15.15 MPa respectively.

The transition creep stress was determined for gypsum and anhydrite and for first gypsum and first anhydrite in laboratory temperature determined as 5.5 and 15.15 MPa respectively. Likewise for second gypsum and second anhydrite it was determined as 6.68 and 9.8 MPa respectively that could be helpful in casing installation stages for wellbore completion processes. The short time creep failure of anhydrite happens because of its rigid and brittle deformation affected by temperature exposing. The stable creep of first gypsum sample happens due to inherent ductile mechanic of gypsum.

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5. References

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