Effect of Oil Contamination on Electrical Resistivity, Mechanical and Anchor Properties of Modified Oil Well Cement

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Abstract:
The effect of oil contamination on the modified oil well cement was investigated. During this study, the portion of oil added into the cement mixture was 6 percent. Oil contamination affected the piezoresistive behavior under the compressive and anchor loading (shear stress) of the oil well cement.

1. Introduction

Over the past two decades, the amount of hydrocarbon contamination of cement has increased and has resulted in damaging of the oil wells. Some sources of hydrocarbon contamination are oil spill, leaking of petroleum from underground storage tanks, oil pipe vandalisation, drilling, and treatment activities for exploration and production of hydrocarbons and hydrocarbon waste disposed from industries. Also hurricanes can affect the oil spillage on the off Shore platforms [1]. Previous studies have been focused on the effect of oil spill on the compressive strength of Portland cement but there is very limited information on the electrical properties of oil well cement contaminated with oil. In this study the effect of oil contamination on electrical properties and compressive strength of modified oil well cement class H was investigated.

2. Objective

Main objective in this study was to investigate the oil contamination on the electrical properties of the modified oil well cement, and also its effect on the compressive strength and anchor rod slip failure

3. Materials and Methods

The cement was mixed with water, the water-to-cement ratio was 0.45 for both contaminated and control specimen. 6% DTE oil as contamination was added to the contaminated specimens, and then they were mixed for 1 minute and poured in to the molds. Plastic cylinder molds of 2 inches in diameter and 4 inches in height were used. Each mold had 4 wires installed to measure the electrical resistance. For studying the cement/casing interface the 5/8 inch rod were glowed in the middle of specimen

4. Result and Discussion

As shown in Figure.1 adding 6% oil decreased the 1 day piezoresistivity of the modified oil well cement by 80% from 58% to 12% at the peak load. Compressive strength of the modified cement reduced due to the addition of 6% oil contamination from the 1.3ksi to 0.5ksi by 61%. From the Figure.2 it can be observed that fractional change in resistivity of 1 day due to the Cement/Casing interface loading reduced by 66% at the peak load. Addition of 6% oil contamination reduced the 1 day Shear strength of the cement/casing interface reduced by 34% from 23ksi to 15ksi.

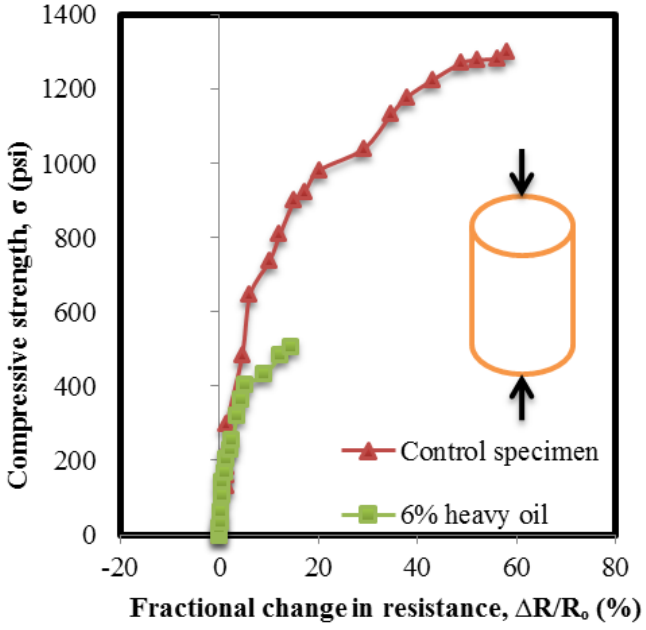

Fig.1. Compressive strength versus fractional change in electrical resistivity

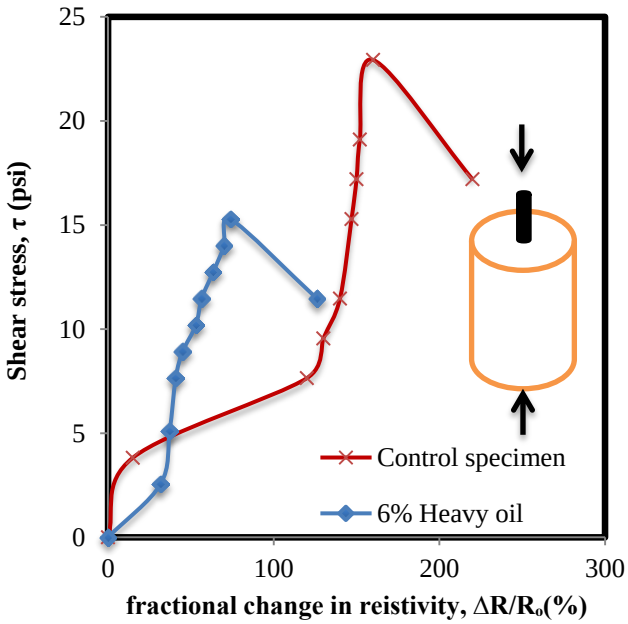

Fig.2. Shear strength applied on the interface versus change in electrical resistivity

5. Conclusion

Oil contamination reduced the sensing properties of the modified oil cement. Factional change in resistivity at the peak load reduced under the compressive loading and shear loading of cement/casing interface by 80% and 60% respectively. Also oil contamination reduced the compressive strength and the bonding shear strength. One day compressive strength and cement/casing bonding shear strength reduced by 61% and 34% respectively.

6. Acknowledgement

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7. References

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