The Effect of Gypsum Contamination on Oil Well Cement Properties

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Abstract: The effect of gypsum contamination on the oil well cement properties was investigated. By adding 3 percent of gypsum to the cement slurry. For the compression test samples are casted in cylindrical moulds and after 24 hours they were demoulded and cured under water. Samples were tested after 14 days. Results indicated that gypsum contamination increased the piezoresistivity of the smart cement but decreased the compressive strength of cement. The shrinkage of the modified cement the decreased with gypsum contamination.

1. Introduction

Gypsum, Hydrous Calcium Sulphatea, is a non-metallic mineral, usually found in rock form. It consists of 79.1% calcium sulphate and 20.9% water, by weight. In the process of cementing the oil well, the cement may be contaminated by gypsum of the rock formation and as a result, the properties of the contaminated oil well cement may deffer from the pure cement. In this paper the effects of gypsum contamination on oil well cement has been evaluated.

2. Objectives

Effects of gypsum contamination on the piezoresistivity, compressive strength, pulse velocity and shrinkage of smart cement was investigated.

3. Materials and Methods

The modified cement was mixed with water with water-to-cement ratio of 0.45 and then the slurry mixed mith 3 percents of gypsum. The mixing time for all the samples was the same and was about to be 4 minutes. The cement slurry was then cast in cylindrical moulds for compressive test. After 24 hours they were demoulded and cured under water for 14 days. The hardened cement was characterized by measuring its resistance at a frequency of 300 kHz and pulse velocity at a frequency of 150 kHz.

4. Result and Discussion

Test results showed that After 14 days of curing under the water, contamination of smart cement with 3% gypsum increased the piezoresistivity of the smart cement by 257% (Fig.1).

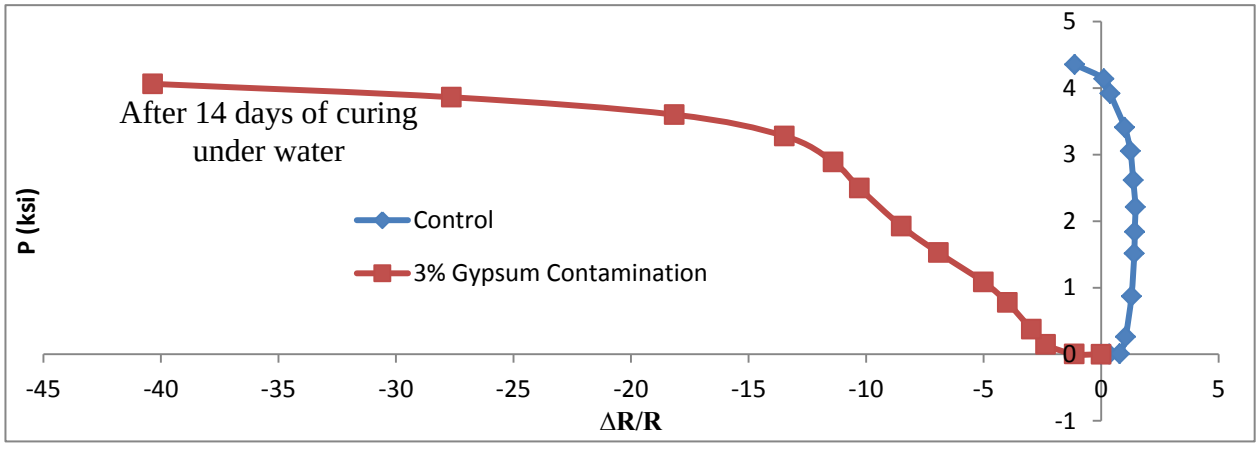

Figure 1. Piezoresistivity of the oil well cement with and without gypsum contamination

Smart cement contaminated by 3% gypsum showed the reduction in the compressive strength by 28%, from 4.55 ksi to 3.8 ksi (Fig.2) and also pulse velocity by 10.5 %, from 3740 m/s to 3350 m/s (Fig.3).

Gypsum contamination alsodecreased the volume shrinkage of smart cement by 80%, from 7.1% to 1.4%, after 24 hours (Fig.4).

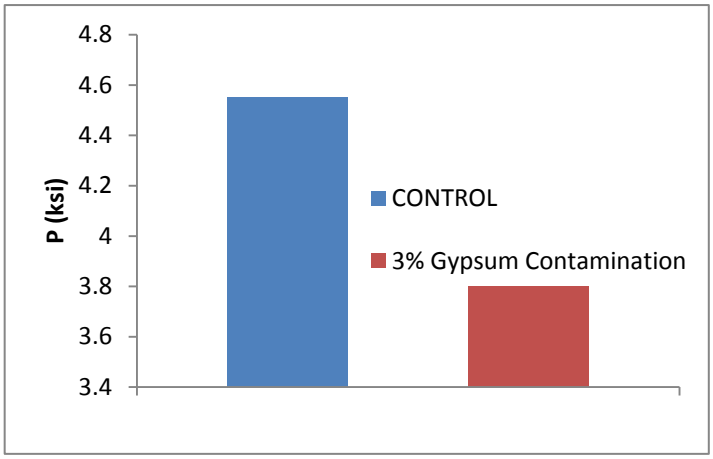

Figure 2. Compressive strength of the oil well cement with and without gypsum contamination

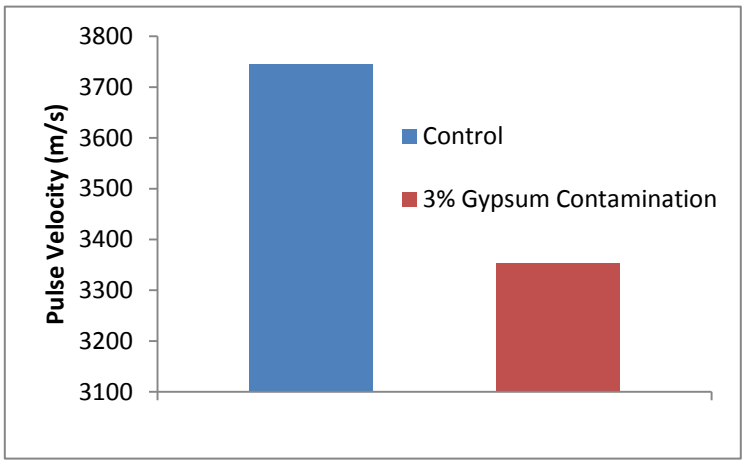

Figure 3. Pulse Velocity of the oil well cement with and without gypsum contamination

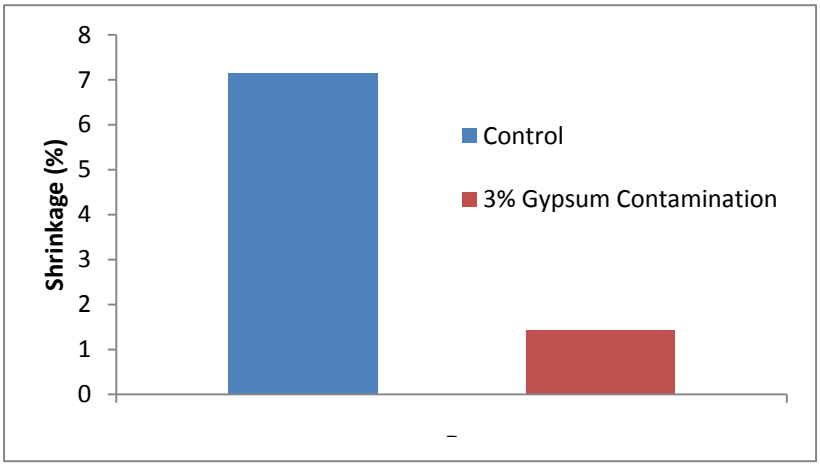

Figure 3. Shrinkage of the oil well cement cement with and without gypsum contamination

5. Conclusion

Gypsum contamination of oil well cement increased the piezoresistivity of the smart cement but reduced the compressive strength, pulse velocity and shrinkage of the oil well cement.

6. Acknowledgement

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7. References

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