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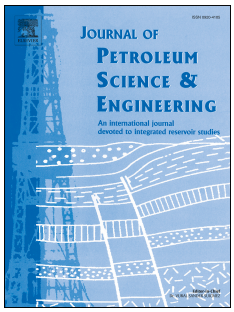

Improving the carbonation resistance of cement stone for oil wells by a polymer with acid response characteristic

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PII: S0920-4105(18)30092-5

DOI: 10.1016/j.petrol.2018.01.080

Reference: PETROL 4667

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 3 July 2017

Revised Date: 22 January 2018

Accepted Date: 30 January 2018

Please cite this article as: Zhang, J., Peng, Z., Zou, C., Chen, D., Improving the carbonation resistance of cement stone for oil wells by a polymer with acid response characteristic, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.01.080.

Improving the carbonation resistance of cement stone for oil wells by a polymer with acid response characteristic

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Abstract: The influences of acid responsive polymer (ARP) on the carbonation resistance of oil well cement were studied by low field nuclear magnetic resonance(NMR), scanning electron microscope(SEM) and X-ray diffraction(XRD), and the mechanism of ARP improving the cement's carbonation resistance was also revealed. The results shown that mixing ARP into cement can significantly decrease the increasing phenomenon of carbonation depth and porosity in cement stone carbonized for a long time, at same time, ARP can weaken the damage for hydration products and microstructures of cement stone from carbon dioxide due to the layer of membrane materials formed on the surface of cement stone encountered acid medium. With the aid of scanning electron microscope(SEM), X-ray diffraction analysis(XRD) technologies, the carbonation resistance mechanism of cement stone improved by ARP was revealed and as follows: (1) Increasing the thickness of the polymer hydration layer being formed on the surface of the cement particles and reducing the contact opportunity between hydration products and corrosion medium; (2) Forming polymeric membrane substance in carbonized environment and blocking the infiltration channels of corrosion medium.

Keywords: Oil well cement, Polymer, Carbonation resistance, Porosity, Membrane material

1. Introduction

It is well known that the carbonation of the cement sheath by CO_2 will reduce the compressive strength and cementation performance of cement stone(Lu,et al.,2001;Duguid et al.,2011;Bai et al.,2015), then the carbonation of the cement sheath not only seriously destroys the sealing effect for cement-casing and cement-formation(Shi,et al.,2012;Zhang,et al.,2007), but also causes the corrosion and perforation for casing and oil pipeline(Bachu.2016), which further leads to huge economic loss for oil field development((Nešić.2007). So it is of great importance to improve the carbonation resistance of cement stone(ring) for continuous production of oil and gas fields.

In recent years, many scholars home and abroad have made much works on the carbonated mechanism and preventive measures about cement stones. For example, researches from (Gaëtan,et al.,2008) have shown that the portlandite after being carbonated can mainly produce more than 100nm harmful holes, reducing the content