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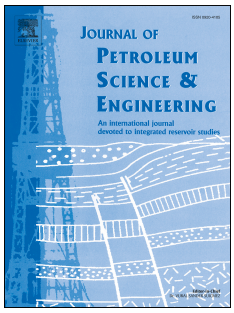

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A novel self-healing spacer fluid for sustained casing pressure mitigation

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Abstract

Sustained casing pressure (SCP) is one of the most common and costly problems in the oil and gas industry, which results in various unfavorable effects in the economy and catastrophic consequences. The development of micro-annulus and micro-cracks within the cement sheath causes the need to develop a unique self-healing spacer fluid to enhance the integrity of cement sheath. This study aims to investigate a novel self-healing spacer fluid that provides a long-term zonal isolation to mitigate SCP problems during well cementing or production operations. Micro-annulus or micro-crack simulation experiments were conducted on artificial cement sheath samples under various confining pressures to investigate the self-healing capability of the novel self-healing spacer fluid. Post-evaluation methods, such as self-healing test and computed tomography scanner, as well as scanning electron microscopy, were used to investigate the effect of the self-healing spacer fluid on the properties of the original cement slurry and repair effectiveness. The self-healing capability of the novel self-healing spacer fluid was assessed based on the conducted experiments and post-evaluation analyses. The effect of the self-healing spacer fluid on the cement slurry properties and casing corrosion was also analyzed. Experiment results indicated that the novel self-healing spacer fluid could penetrate into the micro-cracks or micro-annulus within the cement sheath to activate the hydration reaction of the non-hydrated cement, thereby producing a