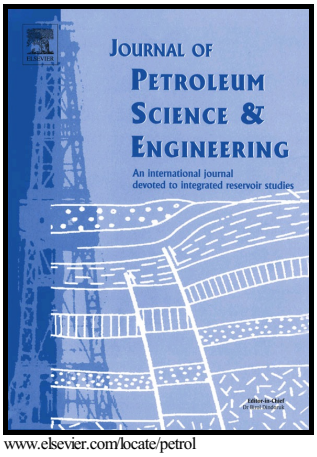

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Abstract

The removal of barite filter cake is a challenging problem because the conventional filter cake removal treatments that use hydrochloric acid (HCl) or chelating agents were ineffective in dissolving barite containing filter cakes. Barite, or barium sulfate, is insoluble in water and acids such as HCl, formic, citric, and acetic acids. Also barite has very low solubility in chelating agents such as Ethylene diamine tetra acetic acid (EDTA) and Diethylene triamine penta acetic acid (DTPA).

The present study focuses on developing new formulation to remove the barite filter cake. The removal formulation consists of chelating agents such as Diethylene Triamine Penta acetic Acid (DTPA), converting agent or catalyst, and polymer breaker (Enzyme). Solubility tests of industrial barite and solids collected from de-sanders during well flow back were conducted to develop barite removing solvent. Actual barite drilling fluid samples were collected from the field during drilling a high pressure high temperature deep gas well. The performance of the designed formulation was examined to remove the filter cake formed by real drilling fluid samples collected during drilling operations using High Pressure High Temperature cell (HPHT).

Based on the result of this work the filter cake removing formulation dissolved more than 90% of the filter cake formed by real barite drilling fluid in a single stage within 24 hours. The removal formulation consists of high pH potassium base DTPA of 20% wt concentration, enzyme as a polymer degrading agent, and one of the following converting/catalytic agents (potassium carbonate, potassium formate, or potassium chloride). The use of converting agents increased the barite solubility from 67% to 95%.

1. Introduction

The drilling fluid must counter or suppress formation pressure. Therefore, the drilling fluid has to have enough density to balance the formation pressure and to keep the wellbore stable. For this reason, weighting materials such as barite, iron oxides, manganese tetraoxide, potassium formate, hematite, and calcium carbonate are used in the drilling fluid to achieve the required mud density (Hossain and Al-Majed, 2015). In deep oil and gas wells, barite is the most common for its desirable density, low production costs, and ease of handling.

For a filter cake to form, the drilling fluid must contain some particles of a size only slightly smaller than the pore openings of the formation (Hassen 1980). These particles are known as bridging particles and are trapped in surface pores, thereby forming a bridge over the formation pores. Filter cake building fluids can also contain polymers for suspension of solids and for reducing liquid loss through the filter cake by encapsulating the bridging particles (Mahto and Sharma, 2004; Plank et al., 1991). Polymers can be either natural or synthetic polymers. The polymers can include one polymer such as xanthan to enhance rheological properties (William et al., 2014; Xue and Sethi, 2012) and a second polymer, a starch for example to reduce fluid loss (Coussot et al., 2004; Dias et al., 2015). At completion of the drilling, however, the filter cake must be removed to allow production of the formation fluids or bonding of cement to the formation at the completion stage. Removal of the deposited filter cake should be as complete as possible to recover permeability within the formation (Al-mutairi and Al-dhufairi, 2010).