Abstract

One of the effective alternatives to minimize this perforation-induced formation damage is by application of underbalanced perforation. Fluid systems with very low density could be used to perforate reservoirs in underbalanced pressure conditions that virtually eliminate or minimize fluid invasion and damage along perforation tunnels. To respond in the needs of such fluid, Saraline-based super lightweight completion fluid (SLWCF) was formulated from glass bubble, stabilizing and homogeneity agent. This paper focuses on a rheological and statistical evaluation of Saraline-based SLWCF and its effect on operating temperature. Eight rheological models, namely the Bingham plastic, Ostwald-de Waele, Herschel-Bulkley, Casson, Sisko, Robertson-Stiff, Heinz-Casson, and Mizrahi-Berk, were used to describe the rheological behavior of the fluid. Based on the results, rheology of the fluid was best represented by both the Sisko and the Mizrahi-Berk models. Furthermore, it is also found that the viscosity of Saraline-based SLWCF was more dependent to temperature changes at low shear rate. The Arrhenius activation energy for the fluid to flow was also found to be decreasing with shear rate and their relationship can be expressed with a power law equation.

Introduction

Perforating is an important process in completing and prepares a well for hydrocarbon production. The created perforation tunnels are the only paths that connects reservoir and wellbores that are cemented with steel casing. Oil and gas well is perforated to allow hydrocarbon flowing through the casing in controlled means, when final depth has been reached. Clean and optimal perforation path is considered as the vital element in determining the productivity of a well (Mustafa et. al, 2009). To create perforation tunnels, a shaped charge perforation gun is the most commonly used method (Papamichos et al., 1993). However the pressure from shaped charge impairs and shatters the rock properties and responsible for permeability reduction, which leads to reduction of flow potential at the crushed zone during perforating activity (King et al., 1986; Bartusiak et al., 1997). This rock property impairment is referred to as "perforation-induced formation damage" (Walton, 2000; Karacan and Halleck, 2003).

One of the effective completion practices to establish clean and undamaged perforation tunnels between wellbore and reservoir rock is through underbalanced perforation (King et al., 1986; Behrmann,