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Impact of temperature on cement paste additivated with nanoparticles

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The oil well construction is one of the most important stages in the oil and gas production, involving the cementation process whose function is to provide an effective zonal isolation between the pipe and the sedimentary rock formation, this process must to guarantee the stability and useful life of the oil well. Enhanced oil recovery processes (EOR) such as Steam Injection, SAGD, CIS, involved critical conditions of temperature and pressure, this condition could affect and compromise the integrity and functions of the cement oil well, causing strength retrogression in the oil cement systems. For that reason, oil industry pursuit to study the effect of nanoparticles within cement matrices in order to enhance their mechanical behavior and extend the useful life of oil wells. The present work shows the experimental results about the temperature impact in two cementing systems additivated with nanosilica and oil nanoalumina (0.5% w/w). Were studied two kinds of cement systems: 1. Synthetic cement system based on pure phases such as C_2S, C_3S, C_3A, C4AF and gypsum) and 2. Oil Portland cement. The cement slurries of each system were additivated with nanosilica and/or nanoalumina particles and a combination of both. The calcination process was carried out after 28 days of curing at 110°C and 200°C for 8 hours. The characterization techniques used were: Infrared spectroscopy (FT-IR), X-ray diffraction (XRD), thermogravimetric analysis (TGA), X-ray fluorescence (XRF), surface area by N_2 adsorption (BET) and Scanning Electron Microscopy (SEM-EDX). It was observed the pozzolanic effect of SiO_2 and Al_2O_3 and very small changes in the polymerization in additivated samples when heated up to 200°C, indicating the resistance of Q_2 bonds Si-O to the degradation by temperature. With BET was observed a low formation of new pores in samples with Alumina, keeping a highly dense structure perhaps the high temperature.

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