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Performance of Synthetic Nano-Zeolite as an Additive for Oil-Well Cement

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ABSTRACT

Challenges encountered in high-pressure/high-temperature (HP/HT) environments have prompted researchers to experiment with different additives that can enhance properties of set cement in a wellbore. Various types of zeolites have been tested previously for cementing high temperature wells in high concentrations as a partial replacement in the cement content. However, the effect of nano sized zeolite, as a cement additive on various cement properties has not been investigated. The influence of nano zeolite (NZ) having particle size less than 80 nanometers on the properties of API Class G cement in the presence of other cement additives was investigated to evaluate NZ as a cement additive. Cement properties, such as thickening time, compressive strength development, porosity, and permeability were studied for HT/HP applications. NZ was added in concentrations 1-3% by weight of cement (BWOC) to evaluate its effect on mechanical and rheological properties. The addition of NZ resulted in accelerating early age compressive strength values, while maintaining higher final strength values as compared to control mix. Required cement compressive strength of 2,000 psi in NZ modified cement slurry was obtained in 33% less time compared to the control slurry, which should reduce the wait-on-cement time. NZ modified slurry has low permeability and low porosity, which should help prevent the intrusion of aggressive fluids from the adjacent formations. The thickening time of the NZ admixed slurry was higher than the control mix, indicating the retarding effect of NZ. In conclusion, NZ may prove to be an effective additive for oil-well cement as it accelerates the compressive strength and produces a robust impermeable cement sheath.