World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:11, No:03, 2017

Rheological Assessment of Oil Well Cement Paste Dosed with Cellulose Nanocrystal (CNC)

Authors : Mohammad Reza Dousti, Yaman Boluk, Vivek Bindiganavile

Abstract : During the past few decades, oil and natural gas consumption have increased significantly. The limited amount of hydrocarbon resources on earth has led to a stronger desire towards efficient drilling, well completion and extracting, with the least time, energy and money wasted. Well cementing is one of the most crucial and important steps in any well completion, to fill the annulus between the casing string and the well bore. However, since it takes place at the end of the drilling process, a satisfying and acceptable job is rarely done. Hence, a large and significant amount of time and energy is then spent in order to do the required corrections or retrofitting the well in some cases. Oil well cement paste needs to be pumped during the cementing process, therefore the rheological and flow behavior of the paste is of great importance. This study examines the use of innovative cellulose-based nanomaterials on the flow properties of the resulting cementitious system. The cementitious paste developed in this research is composed of water, class G oil well cement, bentonite and cellulose nanocrystals (CNC). Bentonite is used as a cross contamination component. Initially, the influence of CNC on the flow and rheological behavior of CNC and bentonite suspensions was assessed. Furthermore, the rheological behavior of oil well cement pastes dosed with CNC was studied using a steady shear parallel-plate rheometer and the results were compared to the rheological behavior of a neat oil well cement paste with no CNC. The parameters assessed were the yield shear stress and the viscosity. Significant changes in yield shear stress and viscosity were observed due to the addition of the CNC. Based on the findings in this study, the addition of a very small dosage of CNC to the oil well cement paste results in a more viscous cement slurry with a higher yield stress, demonstrating a shear thinning behavior.

Keywords : cellulose nanocrystal, flow behavior, oil well cement, rheology
Conference Title : ICCCCT 2017 : International Conference on Cement, Concrete and Construction Technology
Conference Location : Miami, United States
Conference Dates : March 09-10, 2017