

The Influence of Cellulose Nanocrystal (CNC) on the Mechanical Properties and Workability of Oil Well Cement

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Abstract : Well cementing is one of the most crucial and important steps in any well completion. Oil well cement paste is employed to fill the annulus between the casing string and the well bore. However, since the cementing process takes place at the end of the drilling process, a satisfying and acceptable job may not be performed. During the cementing process, the cement paste must be pumped in the annulus, therefore concerns arise both in the workability and the flowability associated with the paste. On the other hand, the cement paste around the casing must demonstrate the adequate compressive strength in order to provide a suitable mechanical support for the casing and desirably prevent collapse of the formation. In this experimental study, the influence of cellulose nanocrystal particles on the workability, flowability and also mechanical properties of oil well cement paste has been investigated. 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. Two method of testing were considered to understand the flow behavior of the samples: (1) a mini slump test and (2) a conventional flow table test were utilized to study the flowability of the cementitious paste under gravity and also under applied load (number of blows for the flow table test). Furthermore, the mechanical properties of hardened oil well cement paste dosed with CNC were assessed by performing a compression test on cylindrical specimens. Based on the findings in this study, the addition of CNC led to developing a more viscous cement paste with a reduced spread diameter. Also, by introducing a very small dosage of CNC particles (as an additive), a significant increase in the compressive strength of the oil well cement paste was observed.

Keywords : cellulose nanocrystal, cement workability, mechanical properties, oil well cement

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