

Why Drilling Fluid Rheology Should be Given more Attention in Geothermal Drilling: A Review

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ABSTRACT

The harsh downhole conditions of high pressure and high temperature (HPHT) encountered in geothermal wells make the drilling operation a challenging task. Drilling in such environments requires a special drilling fluid formulation with high thermal stability and good rheological properties to fulfill the drilling fluid functions effectively. Therefore, great efforts should be put to select the suitable drilling fluid, optimize and monitor the drilling fluid properties throughout drilling operations, and to predict the drilling fluid performance under downhole conditions. Rheological properties have a great impact on many drilling parameters such as hole cleaning, wellbore stability, wellbore hydraulics, and other drilling issues. This paper discusses the rheological behavior of the drilling fluid under HPHT conditions and highlights the significance of drilling fluid rheology in drilling-related aspects in geothermal wells. The main challenges and complications related to drilling fluid rheology encountered in geothermal drilling are also addressed in this paper. This paper also reviews the recent advances in drilling mud systems, rheology enhancement, and rheological properties measurements at surface and subsurface conditions. Moreover, the predictive models of drilling fluid rheology at elevated temperatures are reviewed to better understand the rheological behavior of the drilling fluid and establish a workflow for drilling engineers to optimize fluid formulations for geothermal drilling.