

Feasibility of Using Eggshell for Improving the Performance of Water-Based Drilling Mud in a High Temperature Well

Adesina Fadairo¹, Oni Opeyemi¹, Sven Egenhoff¹, Gbadegesin Adeyemi¹, and Olusegun Tomomewo¹

¹University of North Dakota

Abstract

The utilization of water-based muds has been recommended in drilling operations because they are environmentally friendly, have low economic cost, are easily prepared, and show excellent performance in drilling shale and geothermal wells compared to other drilling fluids if the mud is optimally formulated with the right constituents. The success of any drilling operation depends on the composition, quality and properties of drilling fluid used in the drilling operation. It is essential for the drilling industry to formulate optimum drilling fluid which aids in the effective cleaning of the well, removal of cuttings, suspension of cuttings, cleaning and cooling of the well, controlling formation of pressure to maintain the stability of the well particularly for drilling through formations that have high temperatures and harsh conditions. Studies have shown that eggshell powder nanoparticles have high heat capacity and possess ability to maintain their properties at high temperature. In this study we present the feasibility of using eggshells for improving the water-based drilling mud performance in high temperature wells. Eggshell augmented water-based mud samples were formulated by adding eggshell powder nanoparticles at different weighted amounts into petroleum-industry standardized mud formulae to be used high temperature wells. The formulated mud samples were then experimentally assessed by following the API mud test procedures, e.g., the rheological test, filter press test and pH test under high temperature and high-pressure conditions. The results obtained from this study demonstrate how eggshell powder nanoparticles aid water-based mud to efficiently withstand drilling operation even in a high temperature setting (e.g., in geothermal energy systems) up to between 220 to 300°C. This study shows that the addition of eggshell powder nanoparticle greatly retards the degradation of industrial polymers used in the mud mixture and hence excellently improve the rheological behavior of the drilling fluid at high temperature.