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New formulation for drilling fluids for functional properties.

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Drilling fluids form the basis of drilling operations. Drilling fluids are expected to display desirable rheological, filtration and lubricating properties throughout the drilling operation even when exposed to the extreme conditions of the well. The characteristics of drilling fluids are affected by pressure, temperature and time. The present work deals with the preparation of a suitable base mud with desirable rheological and filtration properties. Water-based muds (WBM) are preferred since oil based muds (OBM) and synthetic-based muds (SBM) are expensive and have severe environmental impact. OBM and SBM have superior lubricating properties, however, considering their drawbacks, WBM are preferred. Several WBM mud formulations were prepared in this study taking into consideration the temperature of the reservoirs. The emphasis here was on deviated wells, high-pressure high-temperature wellsand nanofluid-enhanced drilling fluids. The challenges in drilling problems such as formation damage, pipe sticking, loss circulation, poor hole cleaning and fluid loss need better solutions. Nanotechnology, by means of nanofluids, provides potential solutions for thedevelopment of improved water-based drilling mud (WBM). This work presents the use of nanofluids of CuO and ZnO prepared in various base fluids, such as xanthan gum, polyethylene glycol and polyvinylpyrrolidone, which are commonly used in oilfield operations, for the development of nanofluid-enhanced drilling mud (NWBM). The polymeric components of drilling fluids under extreme temperature conditions result in breakage of polymeric bonds and in degradation of rheology. The retention of heat within the drilling fluid system is the underlying cause. To counter this, the use of Innovative additives which can help enhance the thermal conductivity of the drilling fluids was investigated. Rheological studies on the nanofluid-enhanced drilling fluids were carried out at varying temperatures and pressures. The studies show that the nanofluids help in maintaining the rheological properties, and also enhance the thermal and electrical properties of WBM, thus showing their potential use in advanced drilling operations. In this study, formulations of various nanofluids have been investigated with different concentrations of nanoparticles, such as 0.1, 0.3, and 0.5 wt%, and their effect on the thermal and electrical properties of NWBM has been studied. In addition, the fluid loss properties of NWBM are also investigated in detail. It is observed that the use of nanofluids in WBM helps to improve their thermal properties, with an associated direct impact on their cooling efficiency at down-hole and surface conditions. Filtration loss and filter cake thickness studies on WBM and NWBM have been carried out using an API filter press. The studies, in general, bear testimony to the efficacy of nanofluids in the development of next-generation improved water-based drilling fluids suitable for efficient drilling.

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