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Thermodynamically Predicting the Impact of Temperature on the Performance of Drilling Bits as a Function of Time

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Abstract : Air drilling has recently received increasing acceptance by the oil and gas industry due to its unique advantages. The main advantages of air drilling include the higher rate of penetration, less formation damage, lower risk of loss of circulation. However, these advantages cannot be fully realized if thermal effects in air drilling are not well understood and minimized. Due to its high frictional coefficient, low heat conductivity, and high compressibility, air can impact the temperature distribution of bit and thus affect its bit performances. Based on energy and mass balances, a transient thermal model that predicts bit temperature is presented along with numerical solutions in this paper. In addition, several important parameters that influence bit temperature distribution are analyzed. Simulation results show that the bit temperature increases with increasing weight on bit and rotary speed but decreases as the standpipe pressure and flow rate increase. These results can be used to optimize drilling operations and flow parameters for an improved bit performance as shown in this paper.

Keywords : air drilling, rate of penetration, temperature, rotary speed
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