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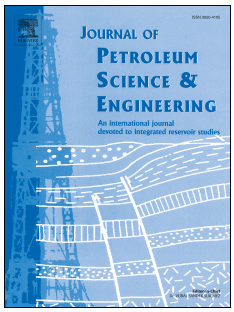

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Wellbore collapse pressure analysis under supercritical carbon dioxide drilling condition

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Abstract: Compared with the conventional drilling methods, supercritical carbon dioxide used in drilling and completion has considerable potentials and many advantages. However, it is found in the research and practice that there are yet many basic problems to be solved. Wellbore stability is one of them. Firstly, in this paper, on the basis of Span & Wagner equation, combined with unique physical properties of supercritical carbon dioxide, parameters such as temperature and pressure in the wellbore while the supercritical carbon dioxide drilling are calculated. Secondly, the heat and mass transfer effect between the supercritical carbon dioxide and the formation has been studied, and the temperature change near the wellbore formation and stress change near the wellbore have been obtained. Thus, pore pressure change near the wellbore has been obtained. When the depth reaches 1500m, the downhole temperature will be 12K lower than the wellbore temperature, and the pore pressure will increase to 20Mpa as the supercritical carbon dioxide seeps into the formation. Thirdly, mechanical properties change rules when rocks are soaked in the supercritical carbon dioxide are obtained through experiments. The compressive strength decreases by 64%, the elastic modulus increases by 153%, and the poisson ratio decreases by 8%. Based on the above research, the wellbore collapse pressure model has been established. It is revealed that the wellbore collapse pressure rises from 9.17Mpa to 16.26MPa with the increase of time, which is still lower than the bottom pressure and cannot lead to instability. Meanwhile, the bottom collapse failure index keeps positive and increases gradually with the increase of time. It means that there is no wellbore enlargement. Therefore, the results have verified the wellbore stability while the supercritical carbon dioxide drilling. It has laid a solid foundation for the future development of supercritical carbon dioxide drilling.

Key words: supercritical carbon dioxide; drilling; pore pressure; collapse pressure; wellbore stability

Introduction

How to develop the oil and gas resources safely and efficiently has been a global

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