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A Novel Method for Natural Gas Hydrate Production: Depressurization and Backfilling with In Situ Supplemental Heat

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Natural gas hydrate (NGH) is the most promising clean alternative energy resource for world. Based on the analysis of the bottleneck problems in hydrate recovery method, the achievement of reservoir-scale production of NGH by depressurization depend on three key factors, namely heat supply, reservoir stability and reservoir permeability. Based on the three principles of depressurization, in-situ supplemental heat and backfilling and increased permeability, the novel method, depressurization and backfilling with in-situ supplemental heat method was proposed. In this method, calcium oxide (CaO) powder is injected into the hydrate reservoir, which will provide a large amount of heat for the decomposition of NGH. At the same time, the $Ca(OH)_2$ produced by the reaction will backfill the void volume left by hydrate decomposition and improve the permeability of the reservoir. The method is mainly implemented in three stages, i.e., horizontal well drilling and completion, powder injection and depressurization and backfilling. Currently, the two-dimension and three-dimension numerical simulations based on this novel method are completed. And the simulation results quantitatively verify the potential value of the depressurization and backfilling with in-situ supplemental heat method from the perspective of the theoretical calculation of numerical model. Based on the key procedures of this method, the related physical simulations for specific operating technique, such as CaO injection and corresponding production performance, are advancing. Combining above promising simulation results, this novel method is expected to be an effective hydrate recovery method.