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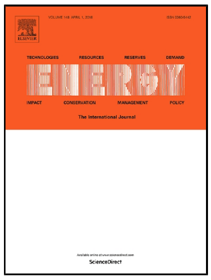

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Influence of Well Pattern on Gas Recovery from Methane Hydrate Reservoir by Large Scale Experimental Investigation

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Abstract

Natural gas hydrate is considered as a potential clean energy resource. Therefore, technology development for commercial gas recovery from natural gas hydrate is attracting extensive attention all over the world. The influence of well pattern on gas recovery from methane hydrate reservoir using depressurization combined with heat stimulation (D&H) method is firstly investigated in a large scale experimental set-up (PHS). The well patterns selected for hydrate decomposition are five-spot vertical wells (5V), dual horizontal wells (2H), and trigonal horizontal wells (3H) in the experiments. The influences of well patterns on the production behaviors, the heat transfer characteristics, and the production efficiency are studied by the experiments. The experimental results indicate that the 5V well pattern leads to the highest gas production rate (R_g), hydrate dissociation rate (R_d), and gas-water ratio, which is the optimal well pattern under the experimental condition in this work. However, by using the 5V well pattern, the heat transfer rate rapidly decreases with the increase of the distance from hydrate dissociation interface to the injection well, which leads to the apparently decrease of the R_d in the later period of the heat stimulation stage. Because the decrease rates of the R_g and R_d by the 5V well pattern is faster than those by the 3H and 2H well patterns, it can be predicted that if the well spacing increases, the 5V well pattern may not be the optimal well pattern for gas recovery. In addition, the R_d using the 3H well pattern is higher than that by the 2H well pattern, because the decentralized heat injection in the 3H well pattern can enhance the heat convection in the sediment, further enhance the heat efficiency.

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