Analysis of the JOGMEC/NRCan/Aurora Mallik Gas Hydrate Production Test through Numerical Simulation

Masanori Kurihara [1], Yoshihiro Masuda [2], Kunihiro Funatsu[1], Hisanao Ouchi[1], Masato Yasuda[3], Koji Yamamoto[3], Masaaki Numasawa[3] Tetsuya Fujii[3] and Hideo Narita[4]

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(1) Japan Oil Engineering Company, Tokyo, Japan.
(2) Department of Geosystem Engineering, School of Engineering, University of Tokyo, Japan.
(3) Japan Oil, Gas and Metals National Corporation, Chiba, Japan.
(4) National Institute of Advanced Industrial Science and Technology, Sapporo, Japan.

Abstract

The gas hydrate production test was conducted using the depressurization methods in the JOGMEC/NRCan/Aurora Mallik production program in early April of 2007. The results of this production test were analyzed, based on all the data acquired during the test; using the numerical simulator (MH21-HYDRES) coded especially for gas hydrate reservoirs. This paper clarifies the observations during the test, numerical modeling and analyses of production test performances through history matching simulation.

A certain amount of gas and water was produced from a 12 m perforation interval of one of the major methane hydrate (MH) reservoirs at the Mallik MH field, by reducing the bottomhole pressure down to about 7 MPa. The gas production rate measured was far higher than that expected for such small drawdown. However, the irregular pumping operations due probably to sand production resulted in the unstable fluid flow inside the wellbore, which made the analysis of test performance extremely complicated.

The numerical reservoir model was constructed as a series of grid blocks, including those mimicking the wellbore, to rigorously simulate the movement of circulated fluid in the wellbore. The model was then tuned through history matching, not by simply adjusting reservoir parameters but by introducing the concept that part of the wellbore fluid might have invaded into the reservoir and that the sand production might have dramatically increased the near wellbore permeability. The excellent agreement between observed and simulated performances revealed the mechanism of MH dissociation/production during the test. Using this history-matched reservoir model, the second year production test performances were predicted to examine the potential of

gas production from the Mallik MH reservoirs, which provided many suggestions on future exploration and development planning for MH reservoirs.

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