THE FEASIBILITY OF GAS PRODUCTION FROM GAS HYDRA TE RESERVOIR WITH OCEAN SURFACE WARM WATER

Yuhu Bai*1,2 Qingping Li1

1. State Key Laboratory of Offshore Oil Exploitation
Beijing 100027
China
2. China National Offshore Oil Corporation Research Institute
Beijing 10027
China

ABSTRACT
A new method is proposed to produce gas from hydrate reservoir by combining the ocean surface warm water flooding with depressurization which can efficiently utilize the effects of thermal, salt inhibitor and depressurization on gas hydrate dissociation. The method is suitable for the gas hydrate exploitation in the sea areas of tropic and subtropic zones or temperate zone in summer. It has the advantage of high efficiency, low cost and relative safety. Based on the proposed conceptual method, the physical and mathematical models are established in which the effects of the flow of multiphase fluid, the kinetic process of hydrate dissociation, the endothermic process of hydrate dissociation, ice-water phase equilibrium, salt inhibition, the convection and conduction on the hydrate dissociation and gas and water production are considered. The gas and water rates, cumulative gas volume for the combination of the ocean surface warm water flooding with depressurization are compared with that of the single depressurization. The numerical results show that the combination method can overcome the deficiency of the single depressurization method. It has the advantage of longer stable period of high gas rate than the single depressurization. It also can reduce the geologic hazard caused by the formation deformation due to the maintaining of the formation pressure by the injected ocean water.

Keywords: gas hydrate reservoir, ocean surface warm water flooding, depressurization, numerical simulation, combination exploitation

NOMENCLATURE

\begin{itemize}
\item \( A \) constant \( A = -1050 \text{J/(kg.K)} \)
\item \( A_s \) specific surface area of porous media bearing gas hydrate \([\text{L}^{-1}]\)
\item \( B \) constant, \( B = 3527000 \text{J/kg} \)
\item \( c_w \) coefficient of compressibility of water \([1/\text{Pa}]\)
\item \( c_o \) coefficient of compressibility of porous media \([1/\text{Pa}]\)
\item \( C \) specific heat \([\text{J/kg.K}^{-1}]\)
\item \( C_{v_g} \) constant volume specific heat \([\text{J/kg.K}^{-1}]\)
\item \( C_{p_g} \) constant pressure specific heat \([\text{J/kg.K}^{-1}]\)
\item \( C_{si} \) initial distribution of salt component \([\text{kg/m}^3]\)
\item \( d_p \) mean particle diameter of porous media \([\text{m}]\)
\item \( D_0 \) molecular diffusion coefficient \([\text{m}^2/\text{s}]\)
\item \( f \) local gas fugacity \([\text{Pa}]\)
\item \( f_{eq} \) gas equilibrium fugacity \([\text{Pa}]\)
\item \( F \) formation electrical resistivity factor
\end{itemize}

* Corresponding author: Phone: +86-10-84523729 Fax +86-10-64662989 E-mail: byh_2002@163.com