

# Development of low speed self-spin nozzle for branch drilling

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## Abstract

Recently, people have large interest in energy problem, and methane hydrate resources are attracted because of large reservoirs found in ocean. However, since methane hydrate is in solid phase, it is required to be degraded to gas phase in development of methane hydrate. For that purpose, effective development methods have not been established. In this study, I propose the branch drilling with water jets to enhance to production rate of methane gas. Since water jet requires a minimum weight on the bit for drilling, this method can provide a light-weight drilling system with low cost. Although a self-spin nozzle system for drilling methane hydrate formations has already been developed, enough drilling performance has not been obtained because the rotational speed of the nozzle system is too high.

In this study, I developed a self-spin nozzle system for a branch drilling system. This nozzle system mainly consists of a conventional self-spin nozzle system and a vane pump for decreasing the rotational speed of the nozzle system. To clarify the influence factor on the rotational speed of the nozzle system, a measurement of the rotational speed was conducted. Main results obtained in this study can be summarized as follows: (1) A self-spin nozzle system with a vane pump for decreasing the rotational speed of the nozzle system was developed. (2) The rotational speed of the nozzle system with the vane pump is much smaller than that of the nozzle system without the vane pump. Therefore, the developed nozzle system is effective to decrease the rotational speed of the self-spin nozzle. (3) The rotational speed of the nozzle system decreases with the diameter of a choke valve installed in the vane pump. This means that the torque induced by the vane pump increases with a decrease in the opening area of the choke valve. (4) The developed nozzle system did not rotate when pressurized water was supplied since the rotational torque is too small. Accordingly, the nozzle should be improved to increase the rotational torque.