Fundamental Study of Self Abrasive Waterjets for Drilling Methane Hydrate Layer under High Water Pressure

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Abstract

To clarify a fundamental drilling performance for methane hydrate formation with self-abrasive waterjets under high ambient pressure, erosion tests for metal plates and fundamental drilling tests for simulated methane hydrate formation were conducted under high ambient pressure of up to 10 MPa. The nozzle system consists of a conventional waterjets system and a guide pipe with abrasive nozzle at the end. Cuttings are sucked into the guide pipe at the open end by an aspirator action of waterjets and are transported to the abrasive nozzle to serve as abrasives. Main results obtained in this study are summarized as follows:

1) A prototype of the self-abrasive waterjets system for the methane hydrate formation under high ambient pressure was developed.
2) The mass loss of metal plates obtained by the self-abrasive waterjets are larger than those obtained by the pure waterjets, and the diameter of high ambient pressures. Accordingly, circulated cuttings remarkably by enhanced the performance of the nozzle system in comparison with the nozzle system without a guide pipe.
3) The specific energy obtained by the self-abrasive waterjets decreases with the ambient pressure. This is because the feed rate of the cuttings increases with the ambient pressure since the aspirator action of the pure waterjets is more effective in a greater ambient pressure. Accordingly, as the ambient pressure increases, the efficiency in the drilling with the self-abrasive waterjets increases.