Shear strength of methane hydrate-supported sand and deformation due to dissociation

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ABSTRACT / RÉSUMÉ
Abstract text (250-500 words) / Texte du résumé (250-500 mots)

A lot of attention has been paid to methane hydrate (hereinafter referred to as MH) as the main energy for the next generation. The existence of about 6 trillion m3 of MH has been estimated in seas adjacent to Japan, and the Research Consortium for Methane Hydrate Resources (MH21 Consortium) has been established as a recent national project in Japan. MH is stable at high pressure and the low temperature, and exists in cemented condition among sand particles in sandy sediments beneath the deep ocean floor. During digging and sampling of MH, concerns are raised regarding the possible exclusion of methane gas due to subsidence and deformation of seabed resulting from the loss in cementing force as MH is dissociated. Therefore, it is necessary to examine the strength and deformation characteristics of ground according to variation in temperature and pressure condition in order to produce MH properly. For this purpose, a low-temperature high-pressure triaxial testing equipment was developed to reproduce the temperature and pressure condition of the seabed where MH exists. Then, MH was generated in the sand specimen set inside the triaxial cell for the purpose of examining its shear strength. A series of drained triaxial compression tests was performed under the same temperature and stress condition as the MH reservoir in deep seabed.

The main findings of this research are summarized as follows.

(1)Methane hydrate could be generated in the pore of sand specimens at the arbitrary degree of saturation.

(2)The strength of MH-supported sand increased as the degree of MH saturation increased.

(3)The strength of MH-supported sand increased with increasing the pore pressure and decreasing temperature.