Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MIS22-P04 Room:Poster Time:April 29 18:15-19:30

Relationship of permeability and particle breakage of experimental fault -Evaluation for the methane-hydrate reservoir-

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Methane hydrate is expected to be an energy resource in the future. As results of coring and logging, the existence of a large amount of methane-hydrate is estimated in the east Nankai Trough, offshore central Japan, where many folds and faults have been observed. Permeability in methane hydrate-bearing sediment is important factors for estimating the efficiency of methane gas production. In this study, we use a ring-shear apparatus to examine the relationship between the permeability and grain size reduction of silica sand sample after large displacement shearing under tested effective normal stresses ranging from 0.5 MPa to 8.0 MPa. The grain size distribution in the shear zone of sand specimen after ring-shearing at each normal stress level is analyzed by laser particle analyzer. The permeability and grain size reduce with the increasing the effective normal stress due to particle breakage. The relationship between permeability and grain size distribution after ring-shearing is expressed well by a curve in each sand, silt and clay size content. In the first group, the sand size content is up to about 80 %, permeability drastically decreases by two orders of magnitude. In the second group, the sand size content is less than about 80 %, the permeability is almost constant. In the silt and clay size, the both contents are up to about 10 %, the permeability abruptly decreases, while, the permeability gradually decreases over about 10 %. The results are indicated that the grain size reduction and the effective normal stress during shearing are one of the controlling factors of the permeability in fault of sand. This study is financially supported by METI and Research Consortium for Methane Hydrate Resources in Japan (the MH21 Research Consortium).

Keywords: Fault, Particle breakage, Permeability, Grain size distribution, Ring-shear test