

Porosity and permeability changes due to shear zone development in sandy sediment
-Evaluation of reservoirs and submarine landslides-

*Sho Kimura¹, Hiroaki Kaneko¹, Shohei Noda¹, Takuma Ito², Hideki Minagawa¹

1.Methane Hydrate Project Unit, National Institute of Advanced Industrial Science and Technology,
2.National Institute of Advanced Industrial Science and Technology (now at RITE)

As a part of a Japanese National hydrate research program (MH21, funded by METI), we performed a study of porosity and permeability changes due to shear zone development in sandy sediment. It is key factor to investigate the characteristics of fault and slip surface in seafloor for the evaluation of gas/oil reservoir and landslide. In this study, to reveal the relationship shear zone development and porosity/permeability change in sand, the shear and permeability tests under constant normal stress were carried out by ring-shear device, and microstructures and grain size analyses were conducted in the samples taken from the shear zone of the specimens after shearing tests. The permeability and porosity after shearing decreased with increasing effective normal stress values in the range of 0.5-8.0 MPa and stress dependency of permeability and porosity was clearly found. On the other hands, the change of permeability and porosity during shear at the effective normal stress of 8.0 MPa was investigated. The permeability and porosity drastically decrease with increasing shear displacement. And the examinations of shear rate effect on permeability at 8.0 MPa were conducted by 2-20 mm/min. The shear rate effect was not significant at tested shear rate range. These are reflected by the porosity reduction, pore size distribution and grain size reduction due to grain crushing in a localized shear zone.

Keywords: Shear zone, Porosity, Permeability, Pore size distribution, Sandy layer, Ring-shear test