

Experimental study on correlation of permeability with physical and chemical properties using Toki granite samples

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Understanding of hydraulic property of rock mass is essential to implement a safe geological disposal of high-level radioactive waste for long term. In order to grasp hydraulic property of rock in detail, we clarified a spatial variation of permeability of Toki granite based on experiment and examined the relation with rock physical properties.

The samples are cores collected from 3 boreholes in Tono area (Mizunami Gifu, Japan) drilled by Japan Atomic Energy Agency. This area is mainly composed of Toki granite. First, permeability was measured using the gas permeameter (Mini-Permeameter MP-401, TEMCO, Inc.). Furthermore, the measurement of P-wave velocities, micro crack properties and chemical composition were performed. As the result, the strongly positive correlation between permeability and cumulative length of micro crack was clarified. Moreover, permeability and P-wave velocity has negative correlation. On the other hand, the correlation between micro crack properties and P-wave velocity was not strong. The reason of these results is that although both of permeability and P-wave velocity are affected by the aperture formed by crack in rock mass, P-wave velocity involves the effect of rock matrix as a medium.

Rock core samples were classified into two groups based on the Mn/Fe ratio. Mn/Fe ratio can be regarded as an indicator to stand for the lithofacies. Mn/Fe ratio corresponded with P-wave velocity variation. The correlation between permeability and P-wave velocity within each group became stronger than the case that all samples were considered.

From these results, the relationship between the permeability and physical properties of Toki-granite is discussed and suggested the method to estimate the hydraulic property from physical properties.

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