Synthetic Study Between Mechanical and Geological Characteristics in Crystalline Rock

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1. Introduction

The KURT (KAERI Underground Research Tunnel) is a research tunnel which is located in KAERI (Korea Atomic Energy Research Institute). Recently, the KURT was extended to obtain the more research modules, and following researches such as engineering and natural barrier system, which are the most important factors for geological repository has been conducted in KURT. To identify the KURT site characteristics, several field tests were carried out since 2007. From the result of field investigations, the site descriptive model around KURT area was finally constructed in 2016. This paper describes the synthetic understanding between rock mechanical and geological properties in crystalline rock around KURT area. In addition, the hydrogeological characteristic can be explained by the rock mechanical understanding.

2. Site characteristics

2.1 Geo-structural characteristic-Fractures

One of the most important geo-structural characteristic is the discontinuities (fractures) in crystalline rock. Orientation of fractures, which was logged in boreholes and KURT inside could be classified with 4 groups by cluster analysis, which are NS, EW, NW and log-angled fracture groups.

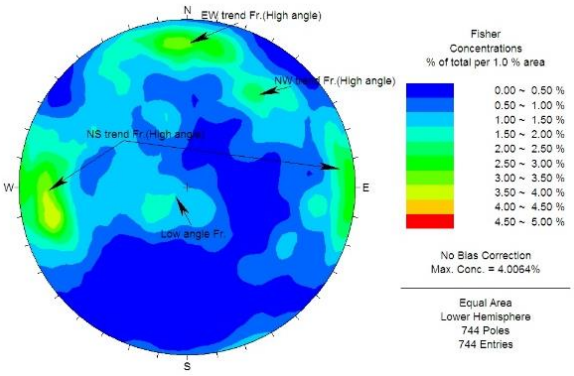

Fig. 1. Orientation of fractures around KURT.

2.2 Hydrogeological characteristic

In-situ hydraulic tests were carried out to focus on the fracture zones in study area. The transmissivities of fracture zones varied from 10^{-3} m^2/sec to 10^{-7} m^2/sec and showed the bimodal distribution (Fig. 2).

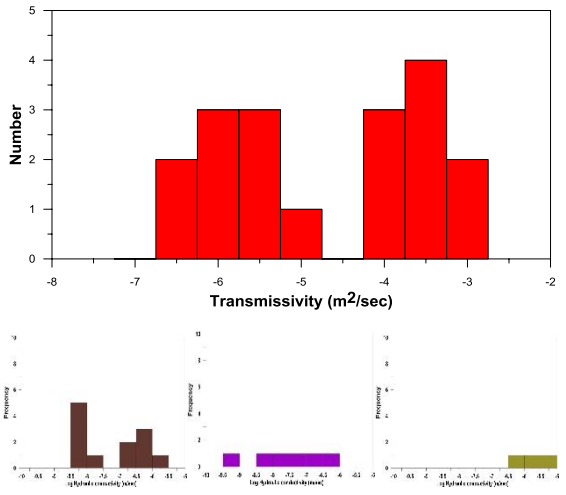

Fig. 2. Transmissivity distribution around KURT.

2.3 Rock mechanical characteristics.

Rock mechanical properties such as orientation and magnitude of in-situ stress were estimated by the hydro-fracturing and DITF measurement test. At results, the orientation of S_{Hmax} was determined as EW trend.

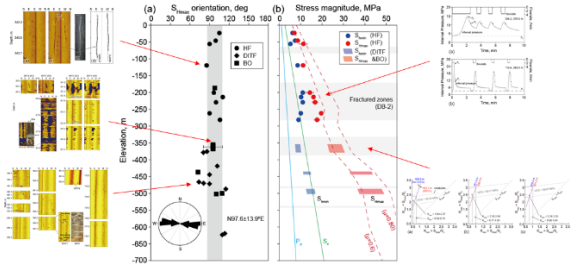

Fig. 3. Rock mechanical properties in DB-2 around KURT.

3. Geo-synthetic understanding

Based on the geological properties, we could assume that two major rock stresses were applied around KURT area in previous. The hydro-geological characteristics told us that there are two fracture zones, which have different hydrogeological properties. That is, the EW trend fracture zone has more permeable than NS and NW fracture zone. These geological and hydrogeological characteristics can be explained by rock mechanical characteristics. EW trend of S_{Hmax} had potential role to make the fracture zone with perpendicular orientation of NS and EW. Also, it could occur the EW tensile fractures, which has relatively higher permeability compared with other fractures with different orientation.

4. Conclusion

The site characteristics around KURT area were described as site description model. Geological, hydrogeological and geo-mechanical model were constructed on the basis of the field investigations. From the results of site characteristics, we can explain that the orientation of fractures and transmissivity of fracture zones are related with the rock mechanical characteristics.

These geo-synthetic approach can help the more understanding of several geo-environmental phenomena.