Application of Downward Compact Conical-ended Borehole Overcoring Technique to Orthotropic rock.

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Accurate determination of rock stress at great depth is one of the most important issues to solve in the fields such as geological disposal of nuclear waste and underground storage of Carbon dioxide at a great depth.

The Downward Compact Conical-ended Borehole Overcoring (DCCBO) technique is one of the stress relief methods. This technique can be applied to a water-filled vertical borehole.

The measurement theory of the DCCBO technique is based on the assumption that rock mass is a homogeneous, isotropic and linear elastic material. However, rock is sometimes very anisotropic and the importance of considering anisotropy in rock stress measurement has been pointed out by several authors. Therefore, application of DCCBO technique to anisotropic rock is required.

Takeda (2007)[19)] suggested the measurement theory to apply DCCBO technique to an orthotropic rock. He also clarified the effectiveness of this theory by simulation. However, experimental verification has not been performed.

The purpose of this study is experimental verification of that theory. Therefore, first, uniaxial tests for determination of elastic moduli of each anisotropy axes, and true triaxial compressive tests for measurement of relieved strains were carried out with 4-type orthotropic rocks. Then the results of stresses evaluated under anisotropic assumption were compared with those evaluated under isotropic assumption.

The results are summarised as follows;

1) The error in the stress evaluated under isotropic assumption is larger than those under anisotropic assumption. Therefore, the effectiveness of this theory for orthotopic rock is verified by the experiment.

2) The error in the stress evaluated under isotropic assumption depends on the degree of the anisotropy in direction of the maximum applied stress.

3) There is little difference in principal stress directions between isotropic and anisotropic assumption.