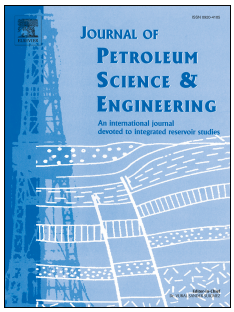
Accepted Manuscript



Determining anisotropic elastic parameters of transversely isotropic rocks through single torsional shear test and theoretical analysis

Yota Togashi, Mamoru Kikumoto, Kazuo Tani

PII: S0920-4105(18)30445-5

DOI: 10.1016/j.petrol.2018.05.051

Reference: PETROL 4980

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 7 March 2018

Revised Date: 10 May 2018

Accepted Date: 17 May 2018

Please cite this article as: Togashi, Y., Kikumoto, M., Tani, K., Determining anisotropic elastic parameters of transversely isotropic rocks through single torsional shear test and theoretical analysis, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.05.051.

ABSTRACT

Deformation properties of sedimentary rock is quite important for evaluating the industrial production of shale gas and the effective design of tunnel constructions, deep rock foundations for nuclear power plant and deep geological disposal. Anisotropic sedimentary rocks, such as shale, can exhibit significantly different material properties in different directions. Knowledge of the anisotropic features of such rocks is, therefore, essential. When a hollow cylinder of an anisotropic material such as a sedimentary rock is torsionally-sheared, the axisymmetry is violated and the stress varies in the rotational direction. Utilizing such stress distributions, we propose a method to determine the parameters of the transversely isotropic elasticity of such a material, including the dominant orientation, via a single torsional shear test using a single hollow cylindrical specimen. A newly designed instrumented cap is also employed. Unlike existing methods, the specimen can be sampled in any arbitrary direction. An overview of the method is presented and its validity is checked both theoretically and numerically. The strain and stress distributions in a hollow cylindrical specimen of a transversely isotropic material is first investigated theoretically, and the stress and strain fields (to which random measurement errors are added) are back-analyzed using the proposed method. The results demonstrate that five elastic parameters, as well as the orientation of the transverse isotropy plane, can be determined uniquely via the proposed method.