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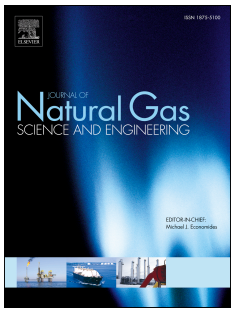

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Permeability evolution of anthracite coal considering true triaxial stress conditions and structural anisotropy

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Abstract: It is critical to understand the gas flow behavior in coal under a reservoir stress condition for coal bed methane production, underground coal mining, and CO_2-sequestration in deep coal seams. With respect to coal seams, the in-situ stress is anisotropic and generally exists under true triaxial stress ($\sigma_1 > \sigma_2 > \sigma_3$) conditions. Additionally, the flow channels determining the permeability of coal are also anisotropic. This dual anisotropy produces difficulties in replicating the gas transport characteristics of coal at the laboratory scale, and there is a paucity of relevant studies. In this study, we performed a series of permeability measurements using cubic anthracite coal samples and changing the principal stresses and flow directions under various true triaxial stress conditions. The coal permeability exhibited greater anisotropy in the vertical direction as a result of the presence of minerals in cleats across the bedding plane. After each principal stress compression at a differential stress of 20 MPa, the permeability in each direction decreased by an order of magnitude. With an increase in the intermediate stress parameter, the permeability values of two horizontal cleats experienced higher decreasing rates compared with the vertical bedding permeability. This increased the significance of the horizontal permeability anisotropy. With