

## **Characterization of pore structural change of shale with water adsorption**

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Shale gas production is directly associated with pore characteristics of shale. Pores in shale act as flow channels or gas storage sites. Accurate quantification of the micro-pore structure is required to understand the fluid flow mechanism in shale. Shale has complex pore structures, which are affected by the clay minerals and adsorption of water on them. The adsorbed water layer can affect the effective porosity by interrupting the movement of other fluids. The purpose of this study was to investigate the pore characteristics of shale at various degrees of water saturation. Water adsorption experiments were conducted on shale and clay minerals contained in the shale by adjusting the exposure time to a specific relative humidity. The pore properties of the samples with various water contents were measured by using Small Angle X-ray Scattering (SAXS) analysis. Shale had three groups of pores (i.e., intra-tactoid, inter-tactoid, and intra-aggregate pores) associated with clay tactoids. Shale had a high fraction of closed and micro-pore, which was related to chlorite and illite. Pore structure of shale was also affected by water adsorption on the clay minerals. The changes in pore structure of shale and clay minerals by water adsorption varied depending on the sample type and pore size. However, water adsorption caused decreases in the total pore volume and the size of the pores.