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The mechanisms of gas generation during coal deformation: Preliminary observations

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Gas generation often occurs during high-temperature and high-pressure deformation experiments on coal. In this work, sub-high-temperature and sub-high-pressure deformation experiments on coal were designed to explore the mechanisms of gas generation during coal deformation. The coal samples for coal deformation experiments were anthracite coals collected from the Qudi Mine in the Southern Qinshui Basin of China. The coal samples showed obvious ductile deformation and CO was generated at a temperature of 200°C, pressure of 75 MPa and strain rate of 10^{-5} s^{-1}. The energy required for CO generation could be calculated by quantum chemistry methods and mechanical energies during these experiments were also calculated. The calculated results suggested that mechanical energy transforms into strain energy during the deformation of coal, and strain energy can promote the deformation and breakage of the coal's molecular units, resulting in deformation energy accumulation of dislocation and creep in the coal's interior nucleus. Upon accumulation of strain energy, the coal's molecular structure deforms by breaking old bonds and forming new ones, resulting in CO generation.

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