Optimizing nutrient delivery by hydraulic fracturing for microbially enhanced coalbed methane (MECBM) production

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Methane within coal seams is a hazard for underground mining. However, with appropriate technology, coalbed methane can be exploited as an important source of natural gas. It is estimated that 90% of coal resource is unmineable but abundant of natural gas. Typically, coal seams are at shallower depth than shales, causing less drill costs. Therefore, with the mature and well-understood technology for coalbed methane, it is an economical and substantial resource.

The recovery and lifespan of a coalbed methane well can be enhanced by enhancement methods. Recent laboratory and field experiments have shown that stimulating microorganisms to produce additional CBM is a practicable method, called microbially enhanced coalbed methane (MECBM) production. The unit of ft^3/ton is used to estimate the methane production for one ton of coal. In laboratory, the production of powered coal saturated by nutrient solution and anaerobic bacteria can be up to 201 ft^3/ton. Coal seams have higher permeability due to the natural fractures and cleats. Hydraulic fracturing can further increase permeability for nutrient delivery and gas immigration.

In this study, we will conduct HF experiments by different fluids to understand hydraulic fracturing characteristics of coal. Breakdown pressure and the change in confining stress will be monitored. The surface roughness of fractured surface are analyzed by optical profilometry technology. The post-fracking permeability of coal for nutrient and gas will be measured for improved bio-gasification.

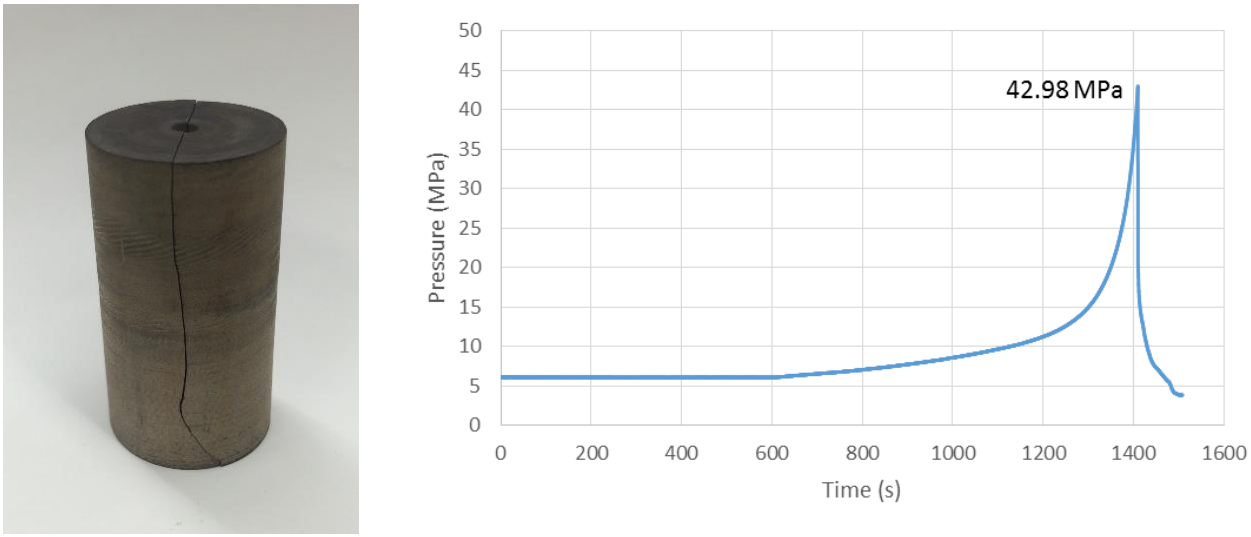

Figure 1. Fractured sample and the typical pressure change during HF experiment.

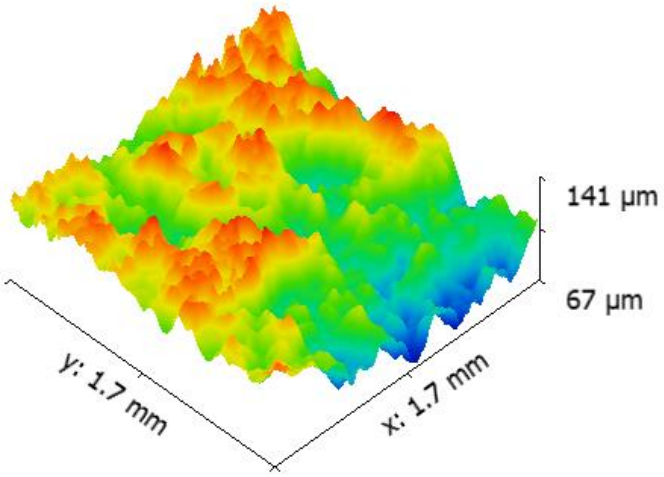

Figure 2. The roughness of surface fractured by CO_2, observed by optical profilometry apparatus.