

# EXPERIMENTS OF WATER'S EFFECT ON MECHANICAL PROPERTIES OF SHALE ROCKS

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The multiple hydraulic fracturing is an indispensable means to improve the production mass of natural gas in development of shale gas. The fracturing water consumption of a horizontal well reaches  $10 \times 10^3 \text{ m}^3$ . However, the water been injected into shale layer is not reverse discharged completely. How does this part of water stays in shale layer? What's the role it plays? And how does it have any effects on the development? We studied effects of water on shale rock mechanical properties experimentally to answer these questions.

## 1 Water Imbibition Experiments of Shale Rock

Experiments show that: the imbibition in surface of shale slice is very big. The mass imbibition rate is about 17%, and volume imbibition rate is about 43% which far more than porosity of shale rock of 3%. The reason is there is a water layer of  $3 \mu\text{m}$  height adhesion at surface of shale rock because of hydrophilic surface. The moving imbibition of water can be observed by super-field depth optical microscope (shown in figure 1).

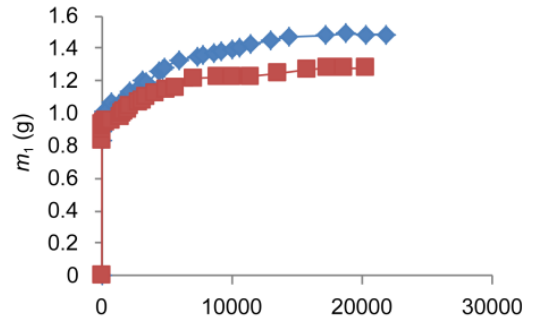


Fig.1 water imbibition on surface of shale rocks

## 2 Change of Shale Rock's Fracture Strength after Water Saturation

Experiments show that: after water saturation, the fracture pressure is greatly reduced from about 30.9MPa to 10.4MPa (shown in fig.2), and it is conducive to produce fracture system, so the production rate of shale gas can be improved. The imbibition water rate is about 7% of volume bigger than porosity of shale rocks because of the hydrophilic surface.

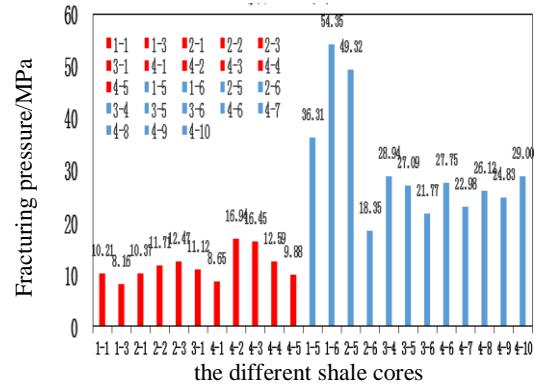


Fig.2 shale's fracturing pressure (blue is dry shale core, red is water saturated shale core)