Water Imbibition of Coal and its Potential Influence on CBM Recovery

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Water/gas mobility and interaction in coal plays an important role in achieving the high performance of coalbed methane (CBM) recovery. A large volume of fracturing fluid is permeated into reservoir during the CBM development. The effect of the imbibed liquid on gas recovery is still controversial. To better understand this phenomenon, a systematical investigation of water dynamic imbibition and matrix permeability change during water imbibition were conducted experimentally using different coals collected from Qinshui, Ordos and Junggar Basin of China.

The research stimulates two different case of spontaneous imbibition and the special imbibition process and imbibition in different pores are concluded by analyzing the imbibition characteristics (i.e. imbibition ability, imbibition rate and imbibition dynamic). The water imbibes into smaller pores and larger pores simultaneously, in which the water imbibition rate is relevant to the porosity, permeability and wettability. The water imbibition in coal matrix can bring about the redistribution and existing state change of water, which probably one of the main factors causing the damage of the matrix permeability. By studying the permeability change and imbibition law, a permeability model is used to explain the influence of imbibition on permeability. Finally, the permeability is found as a function of sorting time and invasion depth, which will be useful for field applications.