Ruyin Li, J Pet Environ Biotechnol 2014, 5:4
http://dx.doi.org/10.4172/2157-7463.S1.008

OMICS Group Conferences
Accelerating Scientific Discovery

2nd World Congress on
Petrochemistry and Chemical Engineering
October 27-29, 2014 Embassy Suites Las Vegas, USA

The adsorption mechanism of methane in coalbed- gas reservoirs

Ruyin Li[1,2]
[1]State Key Laboratory of Offshore Oil Exploitation, China
[2]CNOOC Research Institute, China

The existence of coalbed gas in collierycould be adsorbed gas, free gas, and dissolved gas respectively.Adsorption occurs when the methane molecules adhere to the internal surface of coalmicropores. Physical sorption is the most dominant mechanism accounting for more than90% of the gas stored in coalmatrix. However, little attention was paid on the adsorption process of methane in coalification process, that whether methane is originated at in-situ coal matrix, or comes from other area. Possible mechanism of adsorption between methane and coal matrix are discussed in this work, mechanism of dissolution and diffusion of free methane in aqueous environment of coal cracks isstudied. The adsorption of coalbed methane is determined by its chemical properties. Methane is a non-polar molecule, it's a stable molecule with low potential energy, andtends attractwith very weak polarity materials. The surfaces of natural coal rock composed frommultiplecarbon skeleton macromolecules connectedby some function groups such as aromatic ring, heterocyclic ring, and et.al. The molecularorbital of these carbon skeleton macromolecules are separated and conjugate, which exhibit non-polar property.A few hydroxyl, carboxyl function groups are produced the surface of coal matrix accompany the formation of coal rocks, which result weak polarity of the coal surface. There is a naturally strong attraction between methane and coal matrix for their similar polarity. Water molecules incline to connect with oxic function groups through the bridgeof hydrogen bond on the surface of coal matrix. Polymolecular layers of water or aqueous layersare existed over the coal matrix surface under the effect of hydrogen bond.Competitive adsorption is existed between methane and water molecules on their dominant adsorption positions on the surface of coal matrix.In this way, the adsorption between methane and coal matrix was occurred in aqueous environment. The methane molecules in the coal bed gas couldn't contact with the real surface of coal matrix directlyby means of theseparation of water layer. However, methane molecules could dissolve in the aqueous phase in a small amount through the weak hydrogen bond, which means the solution of methane is formed.After that the methane molecules get to the surface of coal matrix in the water layers. The dissolved methane molecules have higherpotential energy level than other statesbecause it's takes more energy to form the hydrogen bond in the water environment. The energy will be lowered when the methane molecules werecaptured by the non-polar surface of coal matrix, and the adsorption isaccomplished. Pores or cracksare adequate in coal matrix to facilitate the diffusion of methane. Although coal bed methane was generated somewhere in the colliery,it could be transferred in aqueous phase under the driven of concentration gradients in a very far distance in millions of years.It's easy for the coal matrix to adsorb the dissolved methane molecules which are diffused from the other area in the collieryuntil the methane concentration reaches equilibriumin the whole colliery.So, the concept of in-situ formation and storage of coal bed methane is not accurate to describe the coal bed reservoirs. It's facilitating to evaluate the gas reservoirs accurately with the suitable adsorption mechanism.

lrycnooc@163.com