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Porous media evolving mechanism, theory and its applications in Hot Dry Rock geothermal energy and oil shale

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A wide range of solid media gradually evolve into porous media containing a large number of pores, and sometimes voids and fractures, after a single or several coupled physical and chemical actions. This is a very common phenomenon in nature.

It is extremely important in the field of science, engineering and biomedicine, a rise of the research direction and research subject.

The evolution mechanism of porous media is very complex, we consider it roughly divided into three categories: (I) Natural evolution, (II) Artificial evolution, (III) Natural-artificial evolution.

The experimental results: 1) Process of dissolving of salt, evolving properties of solid skeleton; 2) Process of heating, the crack feature of granite (HDR reservoir); 3) Process of pyrolysis, pore and crack feature of oil shale.

Theory: to study the pore and fracture occurrence, development process, the description of the pore morphology and its connected, and control equation for seepage mass transfer, heat transfer in porous media, describing the process of evolution. We put a few mathematical models, i.e. 1) The coupled mathematical model of solid deformation and gas seepage in methane in coal bed mining; 2) The coupled mathematical model of solid deformation, heat transport and seepage in HDR exploitation; 3) The coupled mathematical model of solid deformation, heat and mass transport and seepage in oil shale exploitation. 4) Pore and fracture double media percolation theory of evolving from impermeability to permeability.

Application in China: 1) Geothermal of Hot Dry Rock exploitation, introduction of HDR geothermal resources in China, such as geothermal development, nuclear waste disposal, mechanism and development of oil and gas, groundwater, earthquake prediction. Engineering exploration and development case such as Gonghe County in Qinghai Prov and Yangbajing in Tibet Prov.

2) Oil shale exploitation by injection water vapor in in-situ. Pilot test study in large sample, 20m drilling, 150m of ground pressure, a few of holes the continuous injection of water vapor, another holes discharge by pyrolysis of oil and gas and water vapor steam exhaust. In the process of test, measured pressure, temperature, deformation, acoustic emission events, products change of properties and quantities.

introduce to Xinjiang prov. oil shale geological occurrence conditions and develop technology plan.

References

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