A MINI-REVIEW ON THE FRACTAL-MONTE CARLO METHOD AND ITS APPLICATIONS IN POROUS MEDIA

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Porous media widely exist in nature such as soil, rocks, sandstones, oil/gas//water reservoirs, biological tissue and organics, etc., and in many sciences and engineering applications. Since microstructures of porous media are extremely complicated, this makes very difficult to predict the transport properties such as thermal conductivities and permeabilities of porous media by analytical solutions. Usually, numerical simulations such as control volume method, molecular dynamics and Lattice Boltzmann method etc. are often applied. However, results by numerical simulations are often correlated as empiric expressions, which usually contain one or more empiric constants. Fortunately, many researchers found that the microstructures of porous media have the fractal characters, and transport properties such as thermal conductivities, permeabilities, and gas diffusion coefficients in porous media could be found by applying the fractal geometry theory and technique. In this mini-review, the fractal geometry theory combined with the Monte Carlo method are summarized, and then the current research progresses in several areas are reviewed, including in the areas of permeabilities of porous media, thermal conductivities of porous media, thermal conductivities of nanofluids, rough surfaces, gas diffusivities in porous media and boiling heat transfer etc. Finally, some comments are made regarding the future possible applications.