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A fractal study on effective thermal conductivity of porous media

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Thermal conduction in natural porous media has been deeply paid attention in science and engineering, for example, exploiting and utilizing the geothermal energy, determining the heat flow in hydrothermal systems, obtaining the information about the past climate, modelling the hydrocarbon formation processes and investigating the potential nuclear wastes, etc. The thermal conductivity plays an important role in these fields. Since thermal conductivity is usually difficult to measure, a theoretical model of thermal conductivity inferred from other physical properties is needed. As we all know, the thermal conductivity is strongly influenced by the microstructure features of porous media. In this work, based on the fractal characteristics of the grains, a theoretical model of effective thermal conductivity is proposed for saturated and unsaturated porous media. It is found that the proposed effective thermal conductivity solution is a function of geometrical parameters of porous media, such as the porosity, fractal dimension of granular matrix and the thermal conductivity of the grains and pore fluid. The model predictions are compared with existing experimental data and the results show that they are in good agreement with existing experimental data. The proposed model may provide a better understanding of the physical mechanisms of thermal transfer in porous media than conventional models.

References

[1] B.M. Yu, J.C. Cai, M.Q. Zou, On the Physical Properties of Apparent Two-Phase Fractal Porous Media, Vadose Zone Journal, 8(1) (2009) 177-186.
[2] D. Jougnot, A. Revil, Thermal conductivity of unsaturated clay-rocks, Hydrol. Earth Syst. Sci., 14(1) (2010) 91-98.
[3] A. Revil, Thermal conductivity of unconsolidated sediments with geophysical applications, Journal of Geophysical Research: Solid Earth, 105(B7) (2000) 16749-16768.
[4] P. Ranut, On the effective thermal conductivity of aluminum metal foams: Review and improvement of the available empirical and analytical models, Appl. Therm. Eng., 101 (2016) 496-524.

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