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Pattern Structure of Deterministic Displacement in Random PorousMedia with Dispersion Effect

TIAN Ju-Ping[1] and YAO Kai-Lun[2,3]

[1] Department of Physics, Wuhan Institute of Science and Technology, Wuhan 430073, China
[2] Department of Physics, Huazhong University of Science and Technology, Wuhan 430074, China
[3] CCAST (World Laboratory), P.O. Box 8730, Beijing 100080, China
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Abstract: A new model — model of random porous media degradation via several fluid displacing, freezing, and thawing cycles is introduced and investigated in this paper. The fluid transport is based on the deterministic method with dispersion effect. The result shows that the topology and the geometry of the porous media have a strong effect on displacement processes. The cluster size of viscous fingering (VF) pattern in percolation cluster increases with the increase of iteration parameter n. When iteration parameter $n \geqslant 10$, VF pattern does not change with n. We find that the displacement fluid forms trapping regions in random porous media with dispersion effect. And the trapping regions will expand with the increasing of the iteration parameter n. When r (throat size) $\rightarrow 1$ and $n \geqslant 5$, the peak value of the distribution $N_{mat}(r)$ increases as n increases, where $N_{mat}(r)$ is the normalized distribution of throat sizes after different displacement-damages but before freezing. The peak value of the distribution $N_{inv}(r)$ reaches a maximum when $n \geqslant 10$ and $r=1$, where $N_{inv}(r)$ is the normalized distribution of the size of invaded throat. This result is different from invasion percolation. It is found that the sweep efficiency E increases along with the increasing of iteration parameter n and decreases with the network size L, and E has a minimum as L increases to the maximum size of lattice. The VF pattern in percolation cluster has one frozen zone and one active zone.

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