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Heat transfer and flow structures of Rayleigh-Benard convection in regular porous media[1] SHUANG LIU, LINFENG JIANG, Tsinghua University, KAI LEONG CHONG, University of Twente, XIAOJUE ZHU, Harvard University, ZHENHUA WAN, University of Science and Technology of China, ROBERTO VERZICCO, University of Rome Tor Vergata, RICHARD STEVENS, DETLEF LOHSE, University of Twente, CHAO SUN, Tsinghua University — We report on a numerical study of porous media Rayleigh-Benard (RB) convection for the Rayleigh number Ra from 10^5 to 10^{10} at various porosities ϕ. The porous media is constructed by an array of circular, solid obstacles locating on a square lattice. For a given ϕ two flow regimes are identified with different heat transport properties and flow structures. In the small-Ra regime the heat transport is reduced compared with the classical RB convection without obstacles and the flow is dominated by coherent thermal plumes, while in the large-Ra regime the heat transport is enhanced and the flow is dominated by fragmented plumes. The Nusselt number follows different scaling behaviors in the two regimes, and the regime crossover occurs when the thermal boundary layer thickness is comparable to the particle separation.

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