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The heat transfer of water-based Al_2O_3 nanofluid in turbulent Rayleigh-Bénard convection[1] SHENG-QI ZHOU, RUI NI, KE-QING XIA, Dept. of Physics, The Chinese University of Hong Kong, Hong Kong — We report experimental measurements of the convective heat transfer in water-based Al_2O_3 nanofluid in a cylindrical convection cell, which has 19 cm in both height and diameter. The nanofluid has been supplied by Nanophase Technologyies Inc. with an initial volume fraction (ϕ) 22%. It has been diluted into deionized water to obtain nanofluid of low volume fraction. The nominal diameter of Al_2O_3 particle is 45 nm. At the fixed heating power, $Q = 500W$, it has been found that the convective heat transfer coefficient ($h = Q/\Delta T$, ΔT is the temperature difference across the cell.) decreases to 2% when ϕ varies from 0.03% to 1.1%. At $\phi = 1.1\%$, we have measured the Nusselt number (Nu) as a function of Rayleigh number (Ra). It has been found that Nu of nanofluid collapses on the $Nu \sim Ra$ scaling curve of pure water at higher Ra (4×10^9 to 1×10^{10}). While the deterioration of convective heat transfer has been observed at lower Ra (8×10^8 to 4×10^9), and the deterioration becomes more pronounced with decreasing Ra. Additional measurement on the thermal and flow structures is in progress to understand the convective heat transport in nanofluid.

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Sheng-Qi Zhou
Dept. of Physics, The Chinese University of Hong Kong, Hong Kong

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