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Experimental investigation of heat transport enhancement in bubbly flows BILJANA GVOZDIC, ELISE ALMERAS, VARGHESE MATHAI, DENNIS VAN GILS, CHAO SUN, DETLEF LOHSE, University of Twente — Bubble injection into a carrier fluid can enhance the convective heat transfer. The exact mechanism behind this phenomenon is still unclear since most of the heat transport measurements in bubbly flows are limited to time-averaged global quantities. In this study we measure the statistical properties of the local temperature fluctuations along with global heat flux measurements in a rectangular bubble column heated from one sidewall and cooled from the opposite wall. We varied the Rayleigh number from 10^9 to 10^{11}, and the gas volume fraction from 0.5 to 5%. Due to bubble injection, the Nusselt number is increased up to 20 times as compared to the single-phase case. Surprisingly, we find that the Nusselt number is nearly independent on the Rayleigh number in two-phase flows for each studied gas volume fraction. Furthermore, the Nusselt number is found to be proportional to the square root of the gas volume fraction, which is suggestive of a diffusive process. Local measurements of the bulk temperature fluctuations show that not only are the fluctuations increased up to 100 times due to bubble injection, but also that mixing is present at shorter time scales, which is reflected in the power spectrum of the temperature fluctuations.

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