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# Abstract

Steady state heat transfer by natural convection was investigated experimentally from an enclosed assembly of thin vertical cylinders at high Rayleigh numbers. The published literature lacks any information regarding such a study in the turbulent boundary layer regime. All the available literature is for the laminar region for an enclosed assembly. The enclosed assembly consisted of a 3 x 3 array of vertical cylinders immersed in a large volume tank of water. All the cylinders were electrically heated. Uniform heat fluxes at various power levels were applied to each cylinder and the surface temperature at different positions along the cylinders were measured. The experimental results show that the surface temperature increases axially up to a certain length, then decreases due to some extra mixing which increases the heat transfer. Flow visualization was carried out to observe the flow patterns inside the assembly. The heat transfer coefficient, Nusselt number and modified Rayleigh number have also been presented for the experimental data. Empirical correlations between overall Nusselt number and average modified Rayleigh number have been developed for an assembly of cylinders. This empirical correlation for an assembly is valid for $1.28 \times 10^{12} \leq \overline{Ra_L^*} \leq 1.18 \times 10^{13}$. Generalized correlations are developed for single as well as assembly of cylinders.

The present research is applied to Pakistan Research Reactor-II which is cooled by natural convection. The missing data of surface temperatures of PARR-II is predicted empirically and correlation for bulk outlet temperature from reactor core is presented.