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On Free Convection Heat Transfer near the Critical Point

Hiroshi KONDO*

Recently, investigations on heat transfer near the critical region have been significantly progressed with the development of super critical pressure boiler, reactor, and cooling of gas-turbine. Although during these several years, some experimental and theoretical works were achieved, most of them are concerning to forced convection heat transfer for industrial purposes.

Here presented are the theoretical studies on free convection heat transfer in super critical region and the experimental examination on Freon-12 as a testing fluid.

What experimentally aimed at are the main studies on free convection heat transfer in super critical pressure and critical regions, as well as transport phenomena of fluid at a critical point.

Usually, it is difficult to observe the mechanism of heat transfer by using a forced convection apparatus, so that we made use of a copper cylindrical vessel with observation windows in order to examine inside. Freon-12 is filled up and a platinum wire is set as a heat source inside the vessel.

As results, it is found that the theoretical equation can be expressed by $Nu = F(T)(Pr \cdot Gr)^{1/3}$.

Experimental results show that they agree qualitatively to the results on CO_2 , but that abnormal variations of heat transfer coefficients resulting from the boiling, presented by Nishikawa, was not observed.

*近藤 浩司