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Natural Convection Heat Transfer to Carbon Dioxide Near the Critical Point

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Natural convection heat transfer to fluids near their critical points is becoming increasingly important in convection with such applications as the cooling for the atomic power and gas-turbine plants.

Obtained natural convection heat transfer rates and observed complex fluid motion in the critical region of carbon dioxide, where the physical properties are strongly influenced by the fluid tempere and pressure, are reported in this thesis.

The thin platinum wires, which were electrically heated by the direct current, were provided as the testing heated surfaces. The supplied heat fluxes upon the platinum wire were estimated, measuring the changes in the electrical resistance of the wire by arranged Ampere- and Volt-meters. Moreover, the mean surface temperature of the wire was also determined using the variation of electrical resistance with temperature, which was preliminarily calibrated in detail. The thick-walled copper cylinder, in which the platinum wire and carbon dioxide were equipped, was controlled thermostatically to keep uniform steady temperature fields. The motion of the fluid could be observed and photographed through the window attached to the both ends of the copper cylinder.

In chapter 6, 7 in this thesis, the experimental results relating the heat transfer coefficients with temperature difference between the wire and bulk fluid temperature were described with many graphs and photographs. So called "boiling-like" phenomena, which had been suggested by K. Goldmann in the supper-critical region, were also observed exactly and, futher more, other unusual phenomena were recognized.

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