

Visiting at Institute of Fluid Science Tohoku University

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RESEARCH

During this one month stay, some critical problems related to thermal response of near-critical fluid to point heat pulse are clarified.

First, by numerical simulation, it is found that for long time scales (~100s) and continuous point heating (around 10^5 W/m^3) for Ni point heater, the behavior of microchannel fluid flow can be stable conduction (with only thermal diffusion). The time for the fluid flow to reach steady state heat transfer under point heating at the mid-lower wall of the microchannel is found around 125s.

Then the basic evolution of short time scale (~0.1s) evolution under pulse heating (around 10^{10} W/m^3) for Ni point heater with duration of 0.005s, very strong vortex flow and perturbation are found near the point heater area. Such kind of phenomena is similar with the previous study of microchannel with heating flux throughout the walls (L. Chen et al., Phys. Rev. E, (2013) in press).

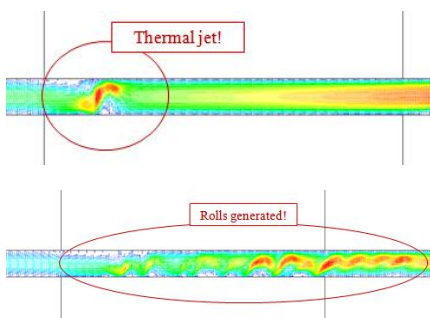


Fig.1 Critical instability.

Together with the above numerical work, experimental flow

lines and basic preparations and primary tests are made. During the tests, basic information and obtaining of supercritical status fluid is confirmed. However, in the high pressure test, more sophisticated design is demanded. We gathered basic experience and knowledge of high pressure critical fluids and it will help a lot in the future tests and improvement.

During this stay, discussions with Prof. Maruyama were carried out each week. Very useful suggestions and new designs are confirmed during this stay. Also during this stay, one international conference paper is finished; two other journal papers are now under preparation. Communication and discussion through internet will continue after this stay with Prof. Maruyama for further development on this project. It is hoped that more result on experiments of near-critical fluid convection and visualization will come out soon. One international conference paper is finished and submitted. Another two or three new international journal papers are in preparation.

FUTURE CONCERNS

- (1) Papers will soon be submitted to international journals; Continue the close discussion with Professor in IFS on previous papers;
- (2) Continue with the numerical work of critical fluid heat transfer in micro-scales;

- (3) Prepare new apparatus for visualization of pulse heating in microchannels;
- (4) Continue with the experimental system design and more tests.

EVENT

SKI TRIP

In 11th Feb, together with Prof. Maruyama and lab members, we went to Yamagata Zao ski field and had very good ski trip. Prof. Maruyama taught us a lot of ski skills and they are very useful. We enjoyed the beautiful white snow scenery in Yamagata-ken and also the delicious food. That is an unforgettable memory for me.



Fig. 2 Ski trip.

FRIENDSHIP AND GRATITUDE

The friendship with the lab members in IFS is really a treasure and unforgettable experiences both in research and leisure time sports also very valuable. The support of GCOE program and the help of GCOE office staffs should really be acknowledged.

In the future, I may visit Tohoku University again for more cooperation and discussion, both on research and the good friendship with Professors and lab members.