

**Condensation in Micro-Channels: Development and Testing of a New
Experimental Approach Using Thermoelectric Coolers**

by

Rose Craft

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Approved:

Michael K. Jensen, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

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ABSTRACT

There is an ever growing trend in today's industry towards higher power devices and decreased device size. This can be seen in the transportation, aerospace, and microelectronics industries. Current cooling technologies are reaching their limits and therefore, new technologies must be developed.

One approach is to use refrigeration systems to lower coolant temperatures. Condensation is an important part of the vapor compression cycle and therefore must be explored, particularly for systems which must be made smaller and lighter through the use of microchannels. Correlations used to predict condensation heat transfer at the macroscale have not been effective at the microscale. In recent years, condensation in microchannels has been studied by many researchers; however, in most cases, fluid-to-fluid heat exchangers have been used. When using this method, the temperature difference across the cooling fluid is used to calculate the heat flux. Because of the small heat loads required by microchannels, this temperature difference is often small and, therefore, the uncertainties in the calculated heat flux may be quite large. This research hypothesizes that by using Thermoelectric Coolers in place of fluid-to-fluid heat exchangers these uncertainties may be reduced.