Thermosyphon Boiler Enhanced with Spherical Particles

Fall 2000

Project: Using Spherical Particles to Enhance Thermosyphon Cooling Performance for Computer Chip Cooling

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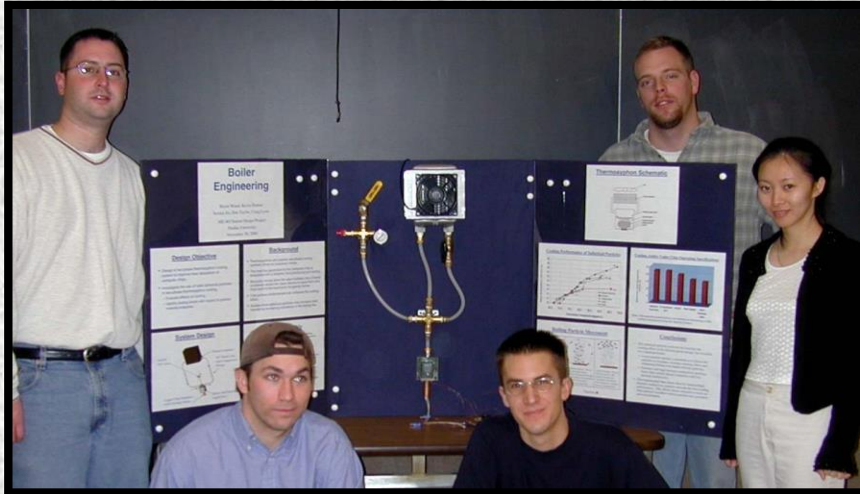
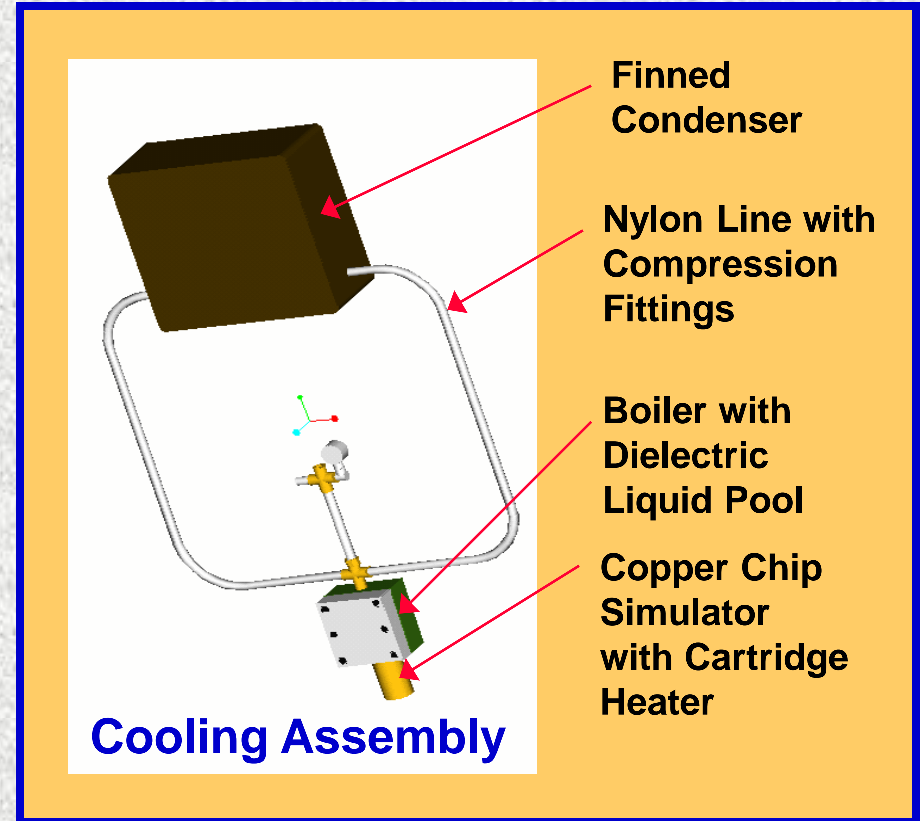
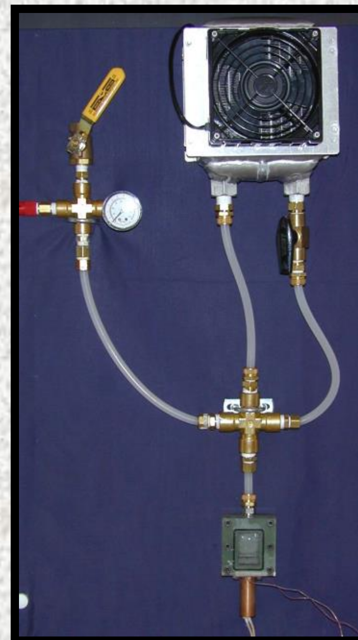




Design objectives

(1) Design a two-phase thermosyphon cooling system to improve heat dissipation from computer chips

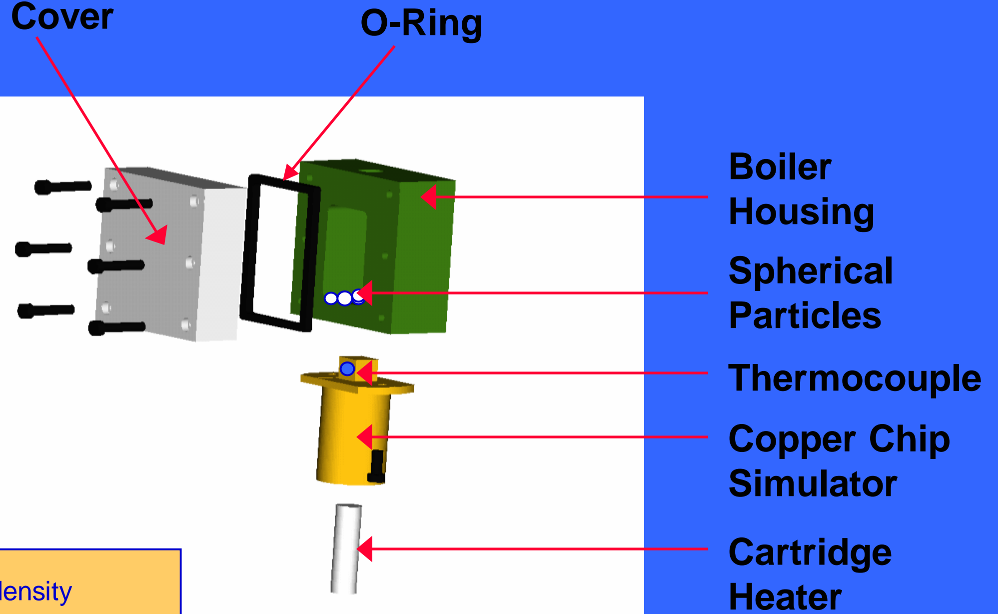
(2) Investigate use of solid spherical particles to enhance boiling process



System Parameters

(1) Liquid fill volume
(2) Type of coolant (dielectric vesus water)
(3) Particle material
(4) Particle size
(5) Packing density

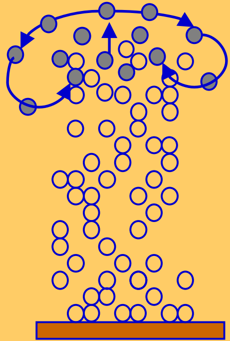
Boiler Assembly



Vapor Bubbles ○

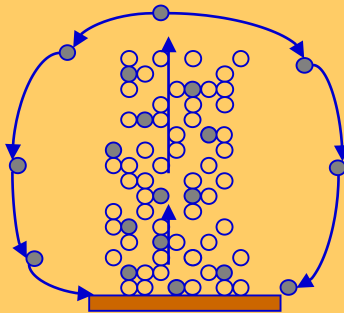
Solid Particles ●

Light particles circulated near free surface of liquid in boiler creating minimal mixing near chip surface



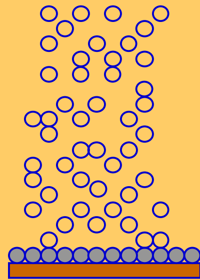
Acrylic

Lower Density Particles circulated throughout boiler creating strong mixing effect near chip surface



Aluminum

High density particles stagnated along chip surface creating no mixing effect



Copper and Stainless Steel

Conclusions

(1) Two parameters dictate particle performance:
- Density
- Thermal conductivity

(2) Optimal particle configuration:
- Moderate density which enhances mixing effect
- High thermal conductivity