Technology Commercialization Opportunity

M-SEBS "Micro-Structured Enhanced Boiling Surface" Increases the Heat Transfer Coefficient and Extends the CHF Limit

Introduction

In recent years, high heat flux removal while keeping the wall temperature below a desired limit has received a lot of attention. The major thrust of the development comes from the computer chip cooling application. The high heat flux removal needs to be balanced with the system complexities.

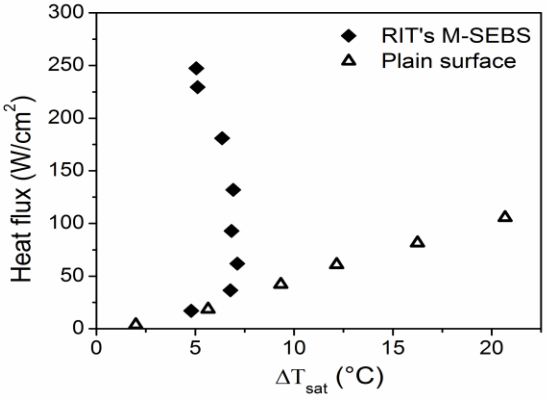
Efficient boiling surfaces are desired in many applications, from boilers in power plants to high heat flux generating computer chips. The heat transfer coefficients with some of the commonly used techniques are shown in the accompanying table. It can be seen that boiling offers a very high heat transfer coefficient. Although this value of 100,000 W/m^2 °C is high, still higher values are desired to meet the ever-increasing heat removal demands.

RIT has developed a Micro-Structured Enhanced Boiling Surface (M-SEBS) that provides a very significant enhancement in the heat transfer coefficient in boiling. A value of over 600,000 W/m^2 °C has been measured with this high performance surface.

Cooling Method	Heat Transfer Coefficient, h [W/m^2 °C]
Forced Air Convection	25 – 250
Forced Fluid Convection	50 – 1,000
Boiling	2,500 – 100,000
RIT's M-SEBS	Over 500,000

Technology Description

The M-SEBS geometry, developed at RIT, increases the heat transfer coefficients in boiling systems. The M-SEBS has been tested in a carefully designed pool boiling setup to provide accurate measurement of heat transfer coefficient and critical heat flux. The results obtained show a significant enhancement over a plain surface. The heat flux value attained is 250 W/cm^2, which is nearly 2.5 times higher compared to the plain surface heat flux value at CHF condition (The current version of M-SEBS has a CHF limit > 250 W/cm^2). One of the main advantages of this surface is that the heat flux value was attained at a wall super heat of less than 5°C. This remarkable performance has been achieved through a carefully designed and patented heat transfer surface developed at RIT. The enhanced boiling surface is able to deliver a staggering heat transfer coefficient of 500,000 W/m^2 °C at a wall superheat of less than 5 °C for water. Such high heat transfer coefficients are very advantageous in high heat flux removal applications.



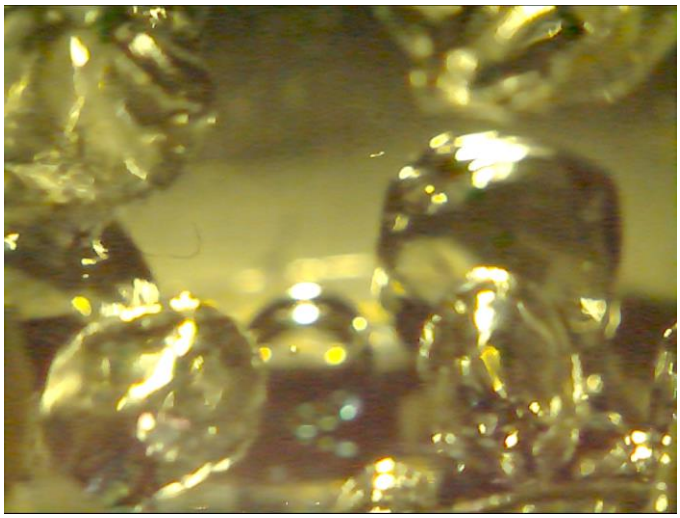
Pool Boiling Curves
Comparison of M-SEBS with a plain surface

Advantages

A product developed using this enhanced boiling surface technology (M-SEBS) would be able to deliver much higher performance compared to similar products available in the market today. The fabrication cost for the surface is very low (based on the simplicity of the design and the availability of the raw materials). Since the developed technology is a surface, it is easier to manufacture at a relatively low cost. The M-SEBS can also reduce costs through reduced energy expenditure, minimal maintenance and upkeep costs as well as through increasing safety thresholds for temperature sensitive equipment.

Technology Readiness

The M-SEBS has been developed, tested and is ready to be installed into a prototype for further testing.



Intellectual Property

The enhanced boiling surface technology is the subject of a pending U.S. patent 20120285664.

Applications

This surface may be used in pool boiling as well as flow boiling systems to enhance the heat transfer rates and extend the CHF limit. It has been tested for water, and the technology can be used to design specific surfaces that are advantageous to other fluids. Listed below are a few target industries that can realize technology-gains for their products.

- Electronics Cooling
  - Microprocessors
  - Data Centers
- HVAC and Refrigeration
- Boiler and Heat Exchangers
- Bio-medical Applications
- Defense Applications

Opportunity

RIT's Intellectual Property Management Office (IPMO) is interested in working with those parties who are qualified and interested in the commercialization of this intellectual property. Arrangement types include licensing the enhanced surface to existing organizations or new organizations that have expertise in this field or related fields.

Contact

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