Public Abstract

First Name:Xin

Middle Name:

Last Name:Feng

Adviser's First Name:James

Adviser's Last Name:Bryan

Co-Adviser's First Name:

Co-Adviser's Last Name:

Graduation Term:FS 2007

Department:Mechanical & Aerospace Engineering

Degree:PhD

Title:EXPERIMENTAL AND ANALYTICAL STUDY ON TWO-PHASE IMPINGEMENT COOLING WITH AND WITHOUT ELECTRIC FIELD

Among the thermal management solutions for power electronics, two-phase jet or spray impingement cooling are two promising candidates. In this study, electrohydrodynamic atomization (EHDA) method is used to generate spray and jet from the same capillary. This approach enables us to compare the heat transfer coefficient and critical heat flux (CHF) in consistent conditions. Two nondimensional parameters are first developed to lay out the various EHDA modes of ethanol. The experimental results show that the EHDA cooling could enhance the heat transfer coefficient in most conditions, while it could not benefit CHF because the electric repulsive force causes a wide spray angle and less impinging mass flux on the surface.

Single and multi micro jet impingement cooling (MJIC) are investigated. Based on the experimental observation and analytical works, a semi-theoretical CHF correlation is proposed based on force and energy balance. The experimental data of water and ethanol are predicted very well by the new model. It also shows the potential to explain the unique feature on the CHF curves of saturated HFE7000 and subcooled ethanol. By using multi MJIC, heat transfer coefficient and CHF might be improved, which mainly depend on fluids and testing conditions.