

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Thermal Design and Microstructure-based Property Assessment for
Thermal Spray Coating Systems

By

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Thermal design and management play critical roles in thermal spray coating systems, and it is important to assess the properties directly from the coating microstructure. In this dissertation, a combined image analysis and finite element method approach is developed to assess thermal conductivity from high-resolution scanning electron microscopy images of the coating microstructure. Images are analyzed with a collection of image processing algorithms to reveal the microscopic coating morphology. The effective thermal conductivity is then simulated using finite element codes. Results are found to be in good agreement with experimental values, obtained using the flash method.

Moreover, the finite element analysis is developed to simulate the flash method for thermal diffusivity determinations. Result shows that for highly heterogeneous materials, there are significant errors for standard flash methods on effective thermal conductivity. The thermal conductivity of thermal spray coating is simulated and experimentally measured by using finite element analysis and flash method, respectively. The results are used for validation and correction to the standard flash method.

Finally, based-on this thermal property assessment technique, the overall thermal management of thermal spray coating systems is investigated, by analyzing the thermal spray coatings annealed in various conditions, and then the long-term thermal performance can be predicted.

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