

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

**Bubble formation during impact of molten metallic
droplets on substrates**

By

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In this defense, I will describe experimental, analytical and computational efforts to understand the formation of nanoporous morphologies on the underside of nickel splats fabricated using air plasma spray (APS.) The formation mechanism is hypothesized as nucleation of gas bubbles due to high impact pressure and rapid post-impact depressurization. Good agreement is found between experimental observations and predictions from classic nucleation theory for bubble in liquid. Systematic experiments showed the effects of process parameters such as spray velocity, distance and substrate material/preparation on bubble/nanopore morphology. It was found that patterning the substrate over different size scales (1 – 100 nm) caused preferential nucleation and hence patterning of bubble structures as well.

The role of surface roughness on splat-substrate adhesion was also studied by considering the bubbles formed and associated with droplet impact and depressurization. Experimental results show that on rough surface the bubble density is significantly decreased. A numerical model shows that on rough surface both the initial impact pressure and depressurization rate is decreased, which provides less driving force for bubble nucleation and growth than on smooth surface. Statistical adhesion experiments show strong correlation between surface roughness, suppression of bubble formation and splat bond strength.

Beyond fundamental interest, this study has applicability in the TS & paint industries, as well as the geologic, volcanic and marine communities.

Date: May 05, 2008

Time: 3:30 PM

Place: Rm 231 Old engineering Building

Program: Materials Science and Engineering

Dissertation Advisor: Andrew Gouldstone