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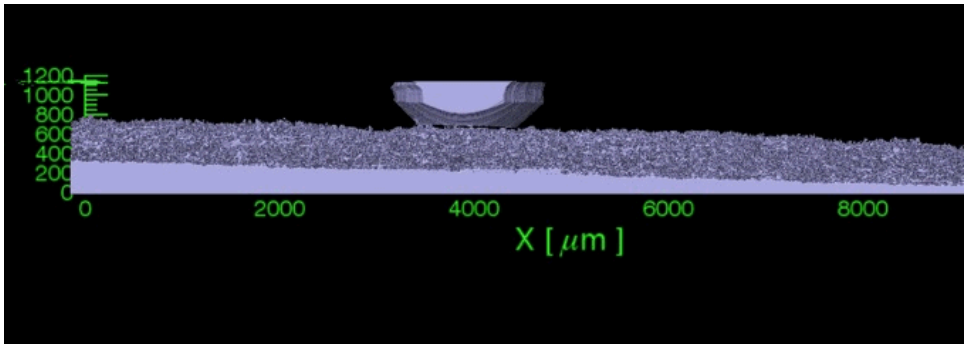

Designing Energy Dissipation Properties via Thermal Spray Coatings

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U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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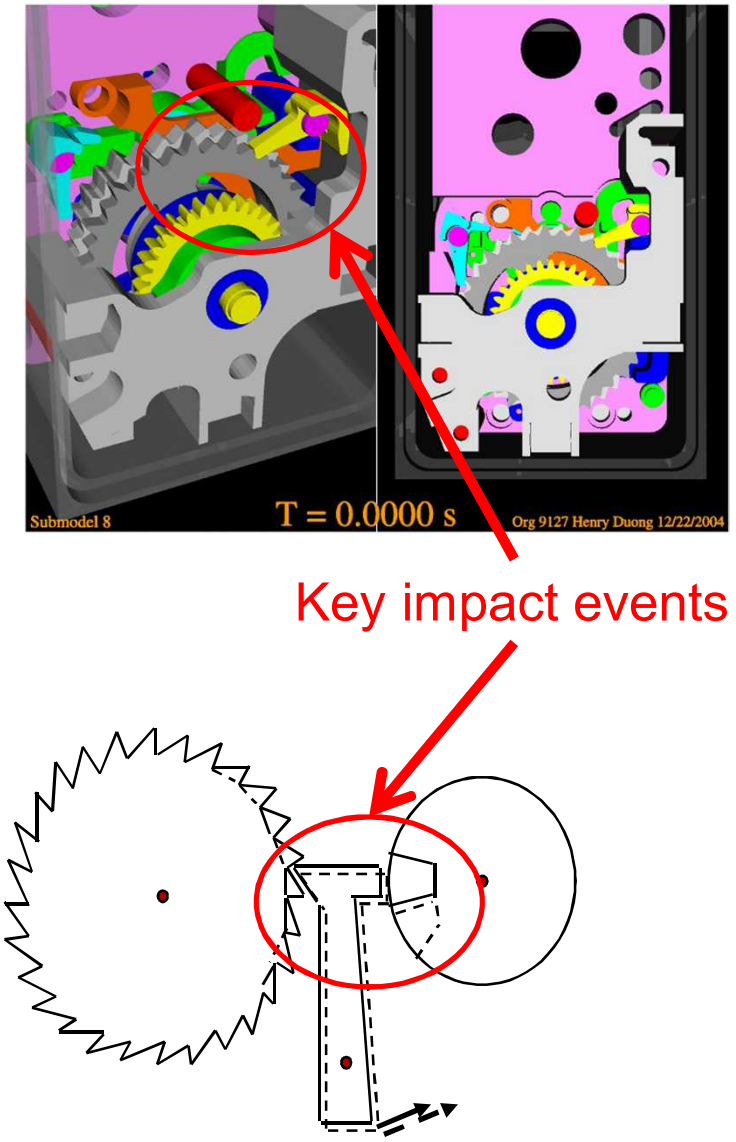
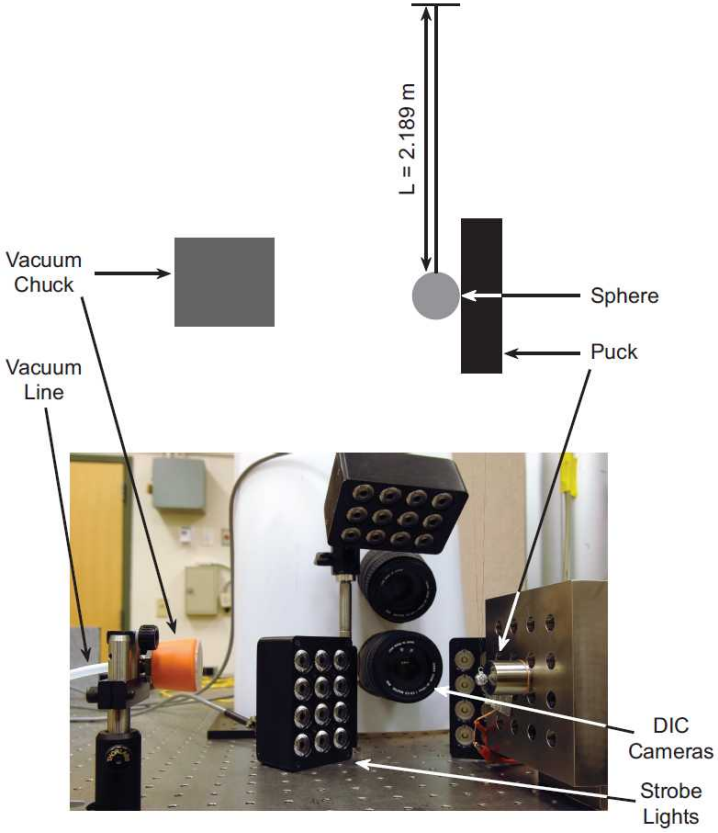
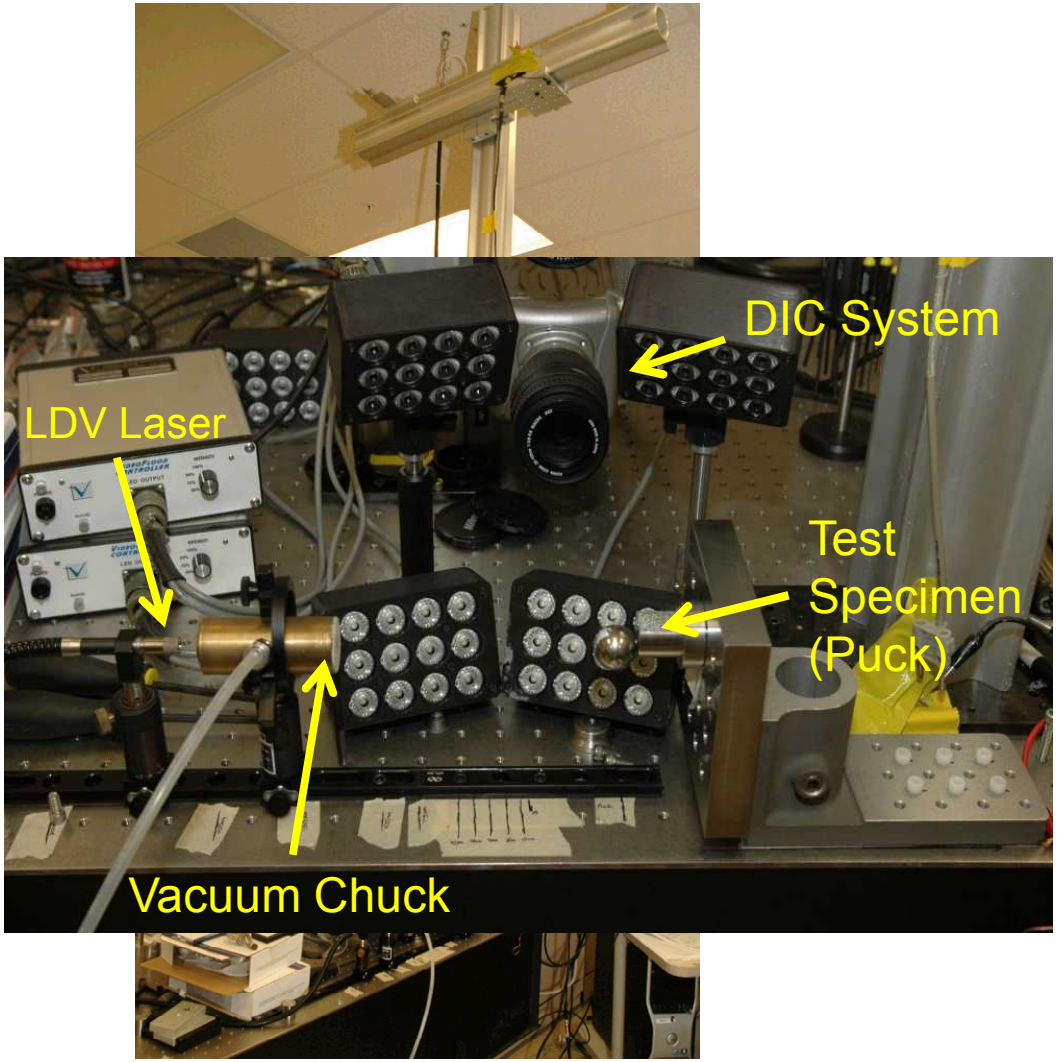
Motivation

- Energy dissipation in components has multiple consequences:
  - Increase in dwell/settling time
  - Potential shock-unlock
  - Wear/ablation effects



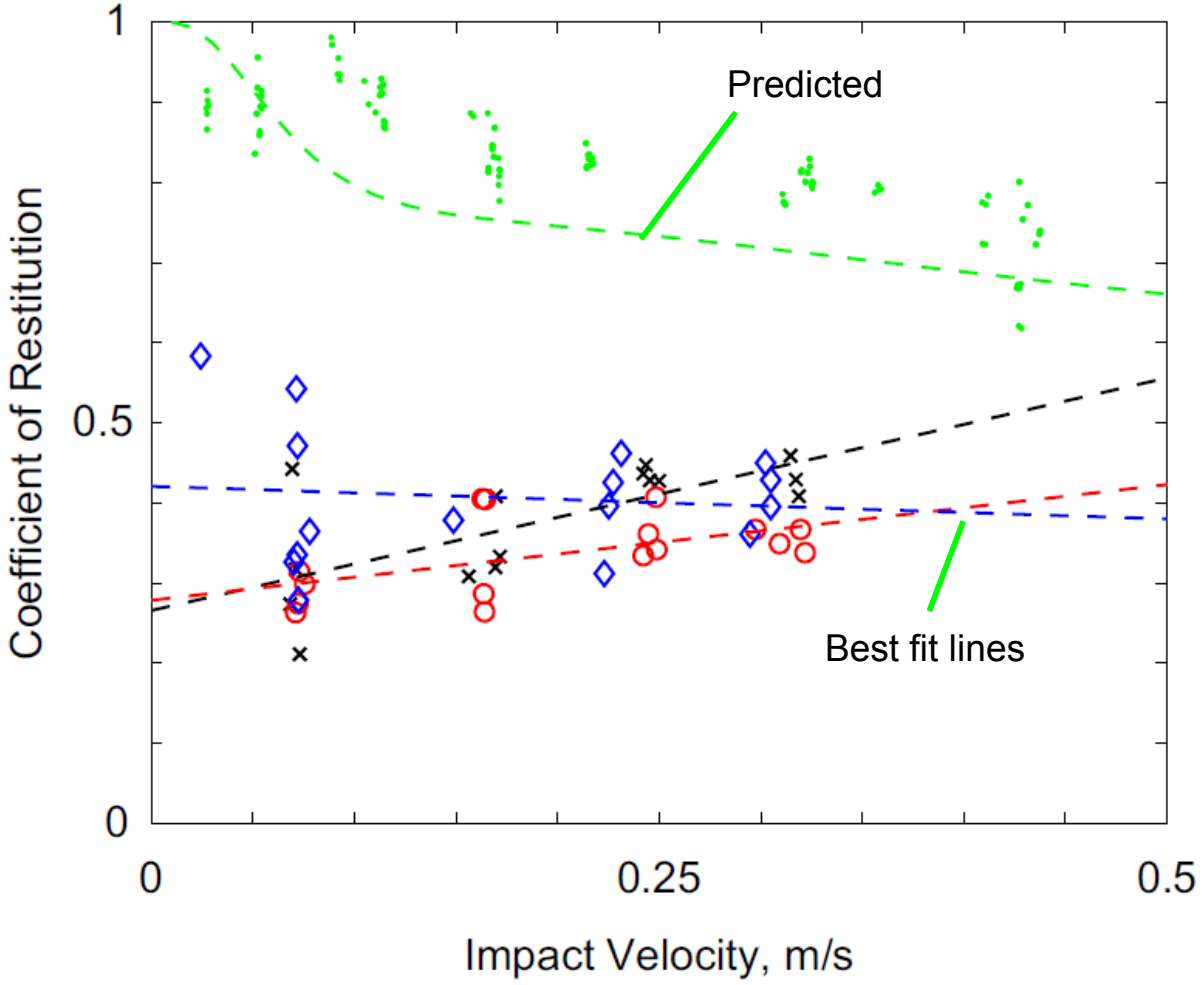
Energy Dissipation Experiments





Measured Energy Dissipation

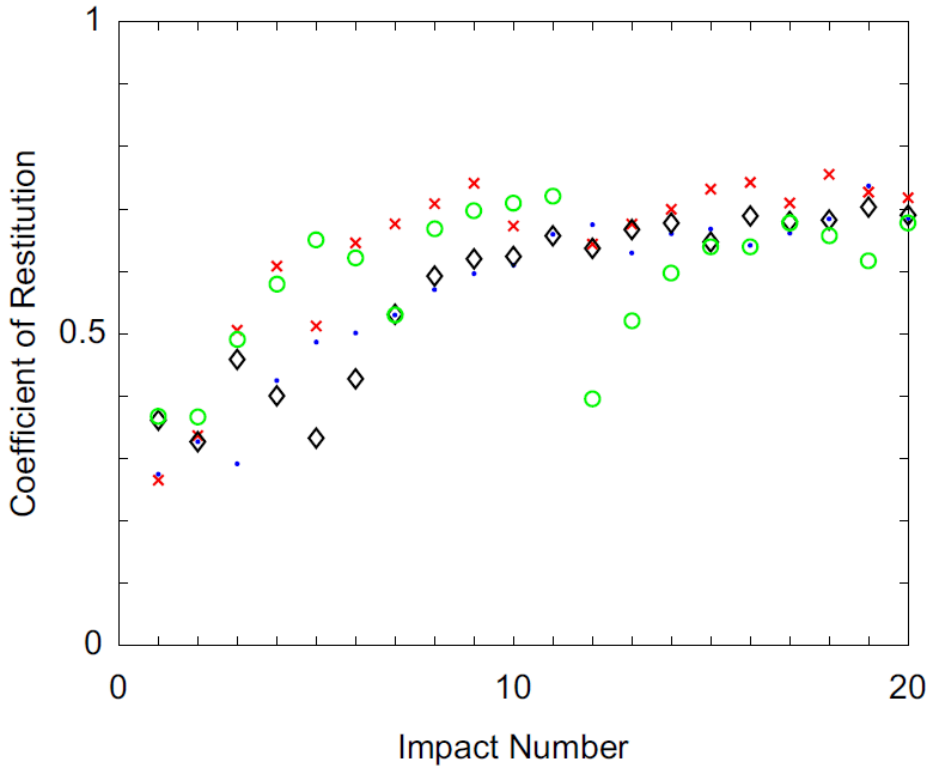
- Effect of coating density studied (SS304 pucks with SS304 coating)



Green: control
Blue: average coating
Black: dense coating
Red: porous coating

Data collected by
Renee Baca and
Dannelle Aragon

Wearing-In Effects



Region where control sample was measured for first impact at these velocities

- Porous coatings, each color corresponds to a different impact velocity (50 mm/s – 300 mm/s)

Optical Inspection of Coatings

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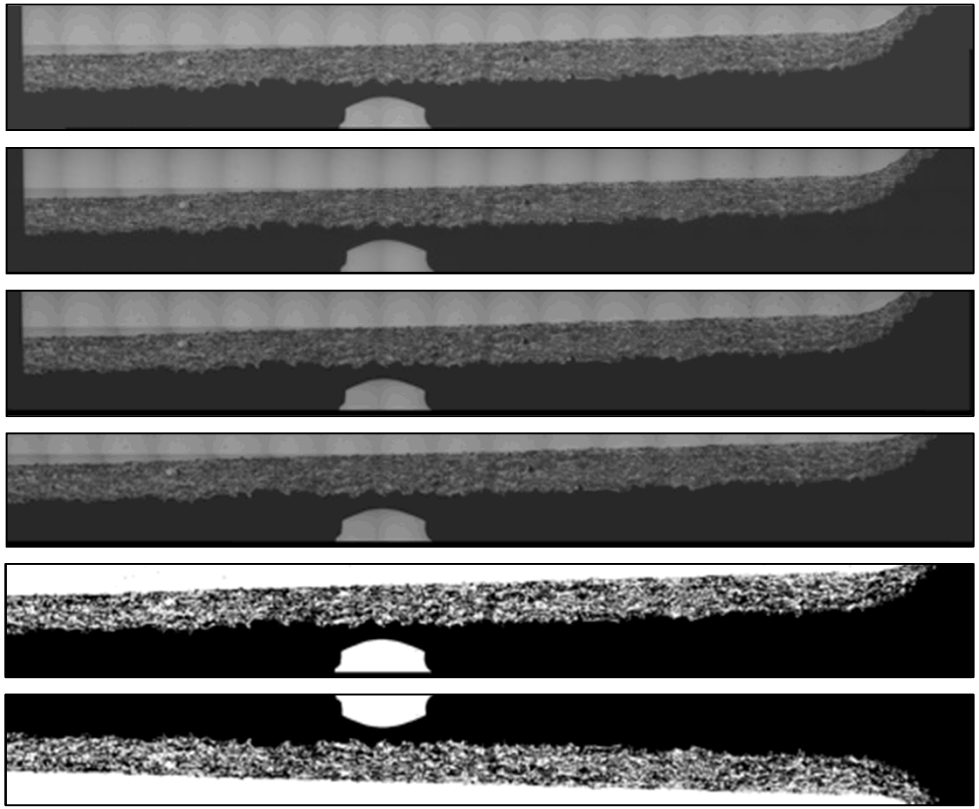
Utilizing a 7 step image segmentation for each image:

1. Make grayscale
2. Autolevel histogram
3. Dust and scratches filter
4. Reduce noise
5. Crop and remove mount epoxy
6. Grayscale threshold
7. Dust and scratches filter

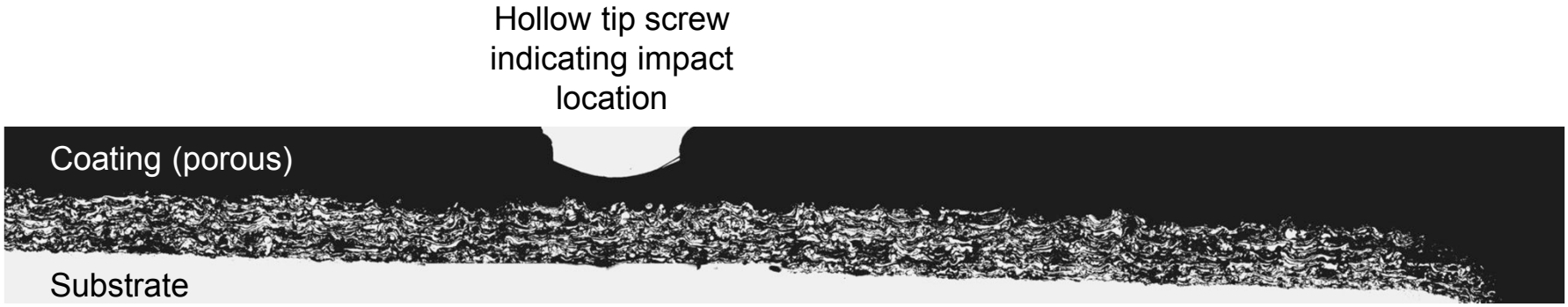


Thermal Sprayed 304 SS – FY 2015

- **Segmentation by J. Madison**: We perform the majority of our image segmentation in Adobe Photoshop™ and FIJI, the later of which is an open-source image processing software born out of NIH's Image J software package. FIJI's primary benefit is that it allows us to process the entire stack of images as one unit as opposed to each individual section one by one.

Investigation of Hypothesized Mechanisms

- **Hypothesis:** wearing in effect comes from flattening of asperities and not permanent changes to the sub-surface microstructure



- Hypothesis further confirmed via topography measurements

Reconstructed Surface Profile

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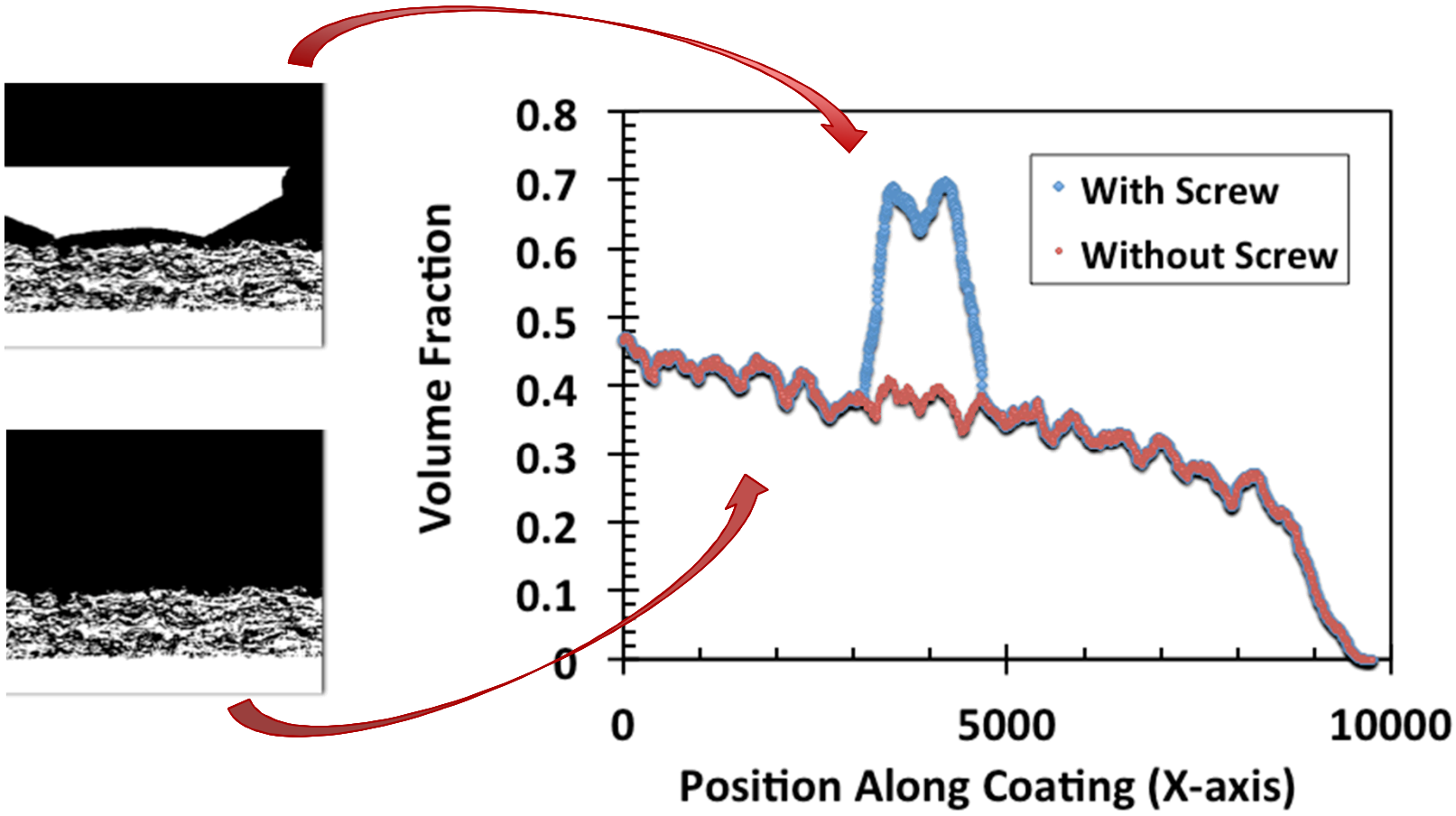
- Volume fraction calculated from the 3d reconstruction of the coating surface



Outlook/Future Work

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- Successful demonstration of proof-of-concept
- Completion of characterization of other samples
- Improved energy dissipation characteristics from a process known to be able to improve wear properties as well
- Opportunity to investigate tailoring of material