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Sandia National Laboratories

Metal Additive Manufacturing of Lattice Structures:
A Study of Process Parameters and Mechanical Performance

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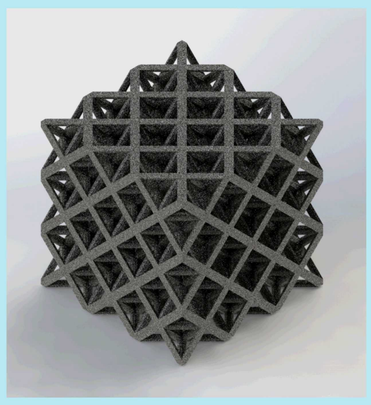
Goals:

- Optimize laser parameters for consistent printing of lattices from the laser powder bed fusion process
- Identify important characteristics in lattices for mechanical properties
- Discover alternative methods for qualification
- Compare cross platform lattices performance



Octet Truss

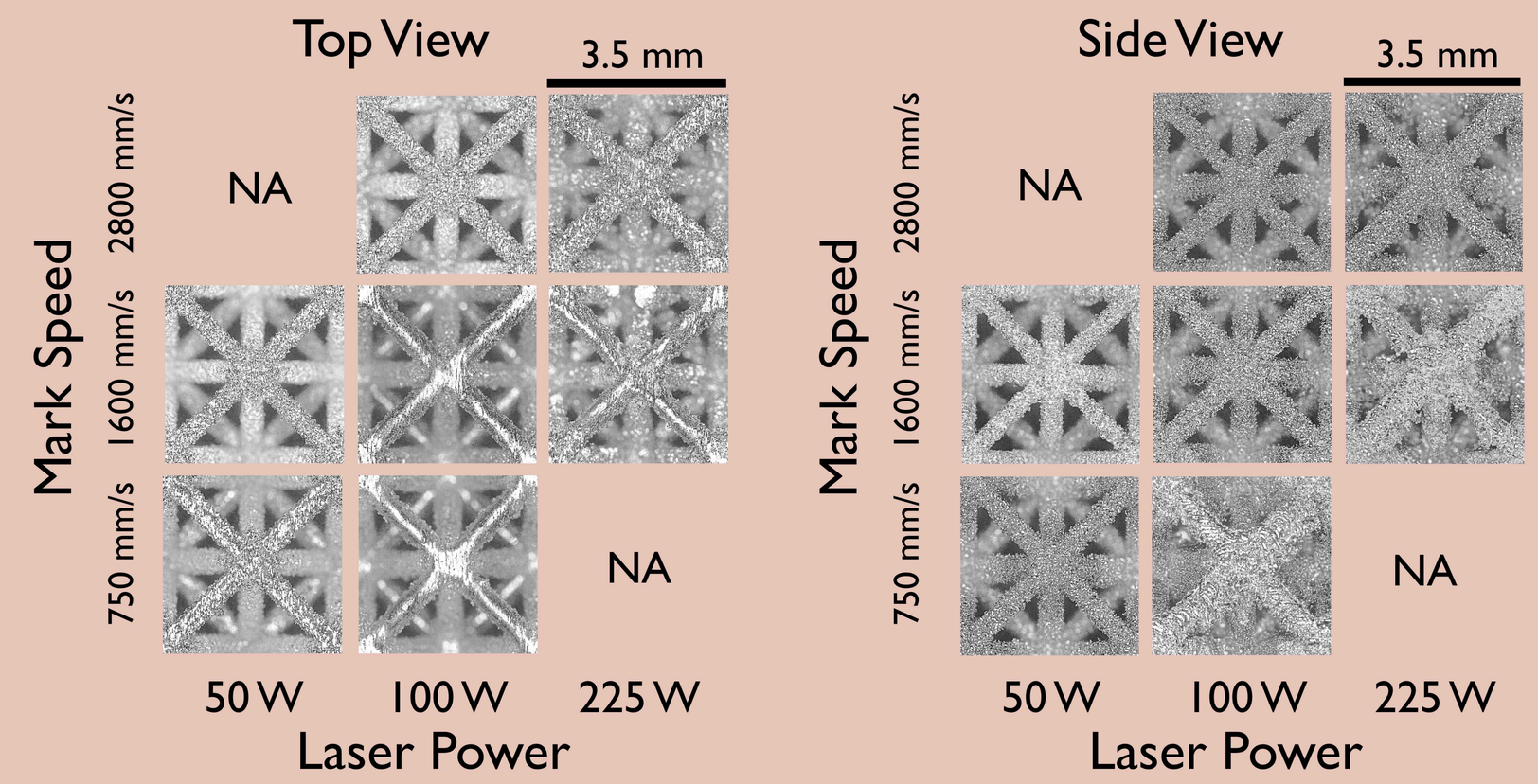
- FCC Lattice Type
- Lattice 20% Fill
- 3x3x3 Unit Lattice
- 10.5 mm Lattice Side Length

Characterization

- Strut Size
- Strut Uniformity
- Surface Quality
- Top View vs Side (Orientation)

Future Work

- CT Analysis
  - Lattice Density
  - Geometric Distortions
  - Broken Struts (Internal)

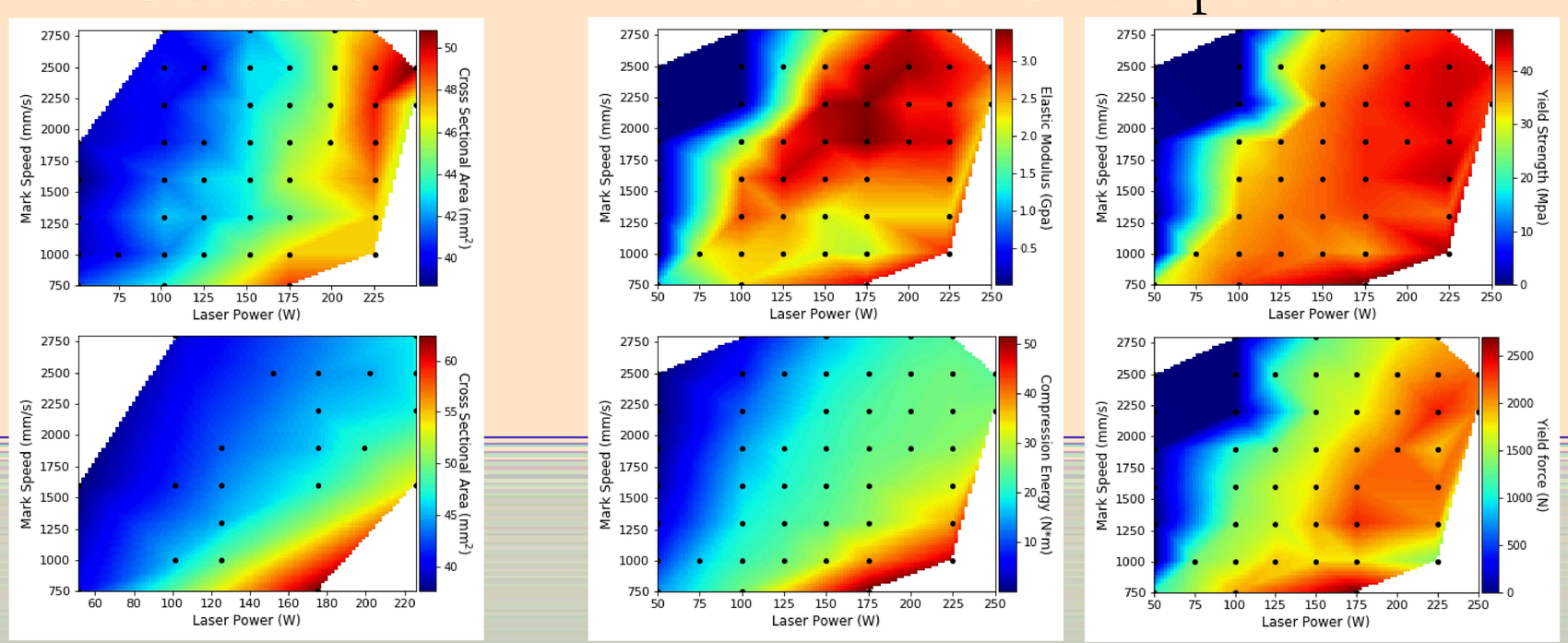


Mechanical Properties

- Strut Size/Features
- Compressive Energy and Side Strut Size
- Strut Size doesn't appear to be the only contributor

Future Work

- Lattice Density
- Completing Side View
- More Data (Strut Size and properties are two different datasets)
- Finish Side View



Summary

- The parameter space for lattice formation has be explored
  - Consistent strut size under specific setting were found
  - Inconsistent surface quality when using parameters that better reflect designed geometry
- Strut size appears to impact mechanical properties like compression energy, though other parameters appear at play
- Additive manufactured parts are hard to characterize, lattices are worse. Future work will include analysis of CT data already collected. Also surface quality will be examined using high resolution optical data.

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