Characterization of Powder Bed Manufactured Copper Cubes

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Background

Copper manufactured through powder bed fusion has historically shown less than desirable material characteristics. This research helps characterize copper manufactured under specific conditions. By successfully characterizing copper it can become possible to link manufacturing parameters to desirable material characteristics.

Methods

Density Measurement
Conductivity Testing
Grinding and Polishing for EBSD

Conductivity Testing

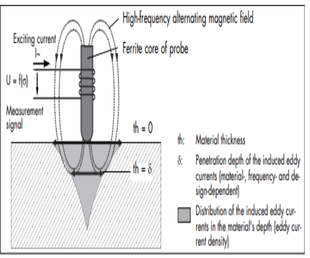


Figure 1. Conductivity Tester

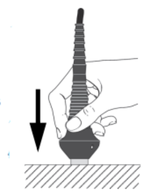


Figure 2. Demonstration

References

Ho, V., Ladani, L., Razmi, J., Gruber, S., Murphy, A. B., Chen, C., East, D., & Lopez, E. (2025). *Powder Bed Fabrication of Copper: A Comprehensive Literature Review.* Metals, 15(10), 1114. https://doi.org/10.3390/met15101114

MSE Supplies LLC. "Electron Back Scatter Diffraction (EBSD) Analytical Service." *MSE Supplies*, 2025, https://www.msesupplies.com/products/electron-back-scatter-diffraction-ebsd-analytical-service?srsltid=AfmBOoqfoI67yaQQ9ObRkHT1pXQbYTqARLd0HcqWe16XuSJV73pNBCr8.

Helmut Fischer GmbH. *SIGMASCOPE SMP350 Owner's Manual*. Fischer Technology Inc., n.d.

Grinding and Polishing

Figure 3. 400 Grit Grinder

Figure 4. 800 Grit Grinder

Figure 5. 1 Micron Polish

Progression

400-600-800-1200-9µm-3µm-1µm-0.25µm-0.05µm-vibratory polishing

Results

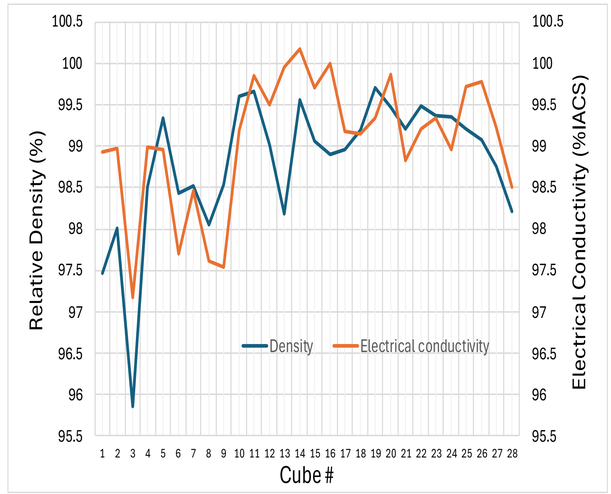
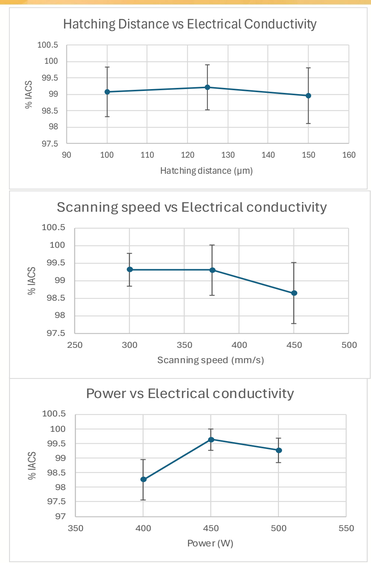


Figure 6. Electrical conductivity vs density chart



Figures 7,8,9. Hatching distance, scanning speed, and power vs electrical conductivity charts

Future Work

EBSD Characterization would allow for in depth understanding of grain boundaries and grain growth

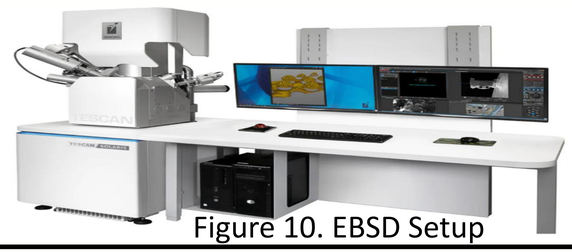


Figure 10. EBSD Setup

Analysis

Density and Electrical Conductivity are closely linked, as expected. But higher scanning speeds, power, and hatching distance don't necessarily increase density and thus conductivity. There is a middle ground of parameters that produce the highest density – and thus highest quality - cubes.

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