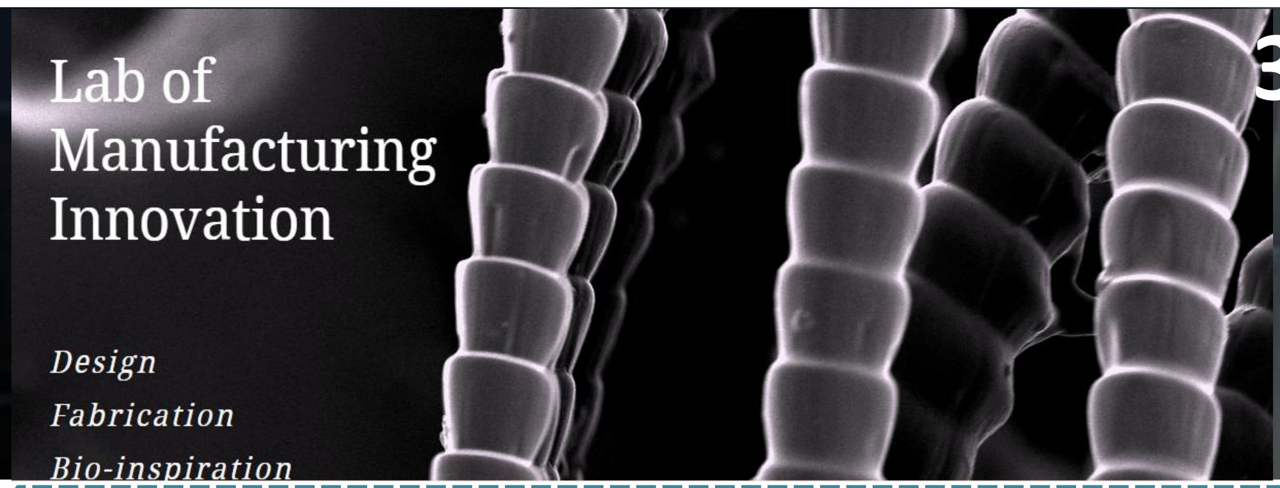

3D Printing of Alloy Structures using Ultrafast Layerless Continuous Printing

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1. Motivation & Overview

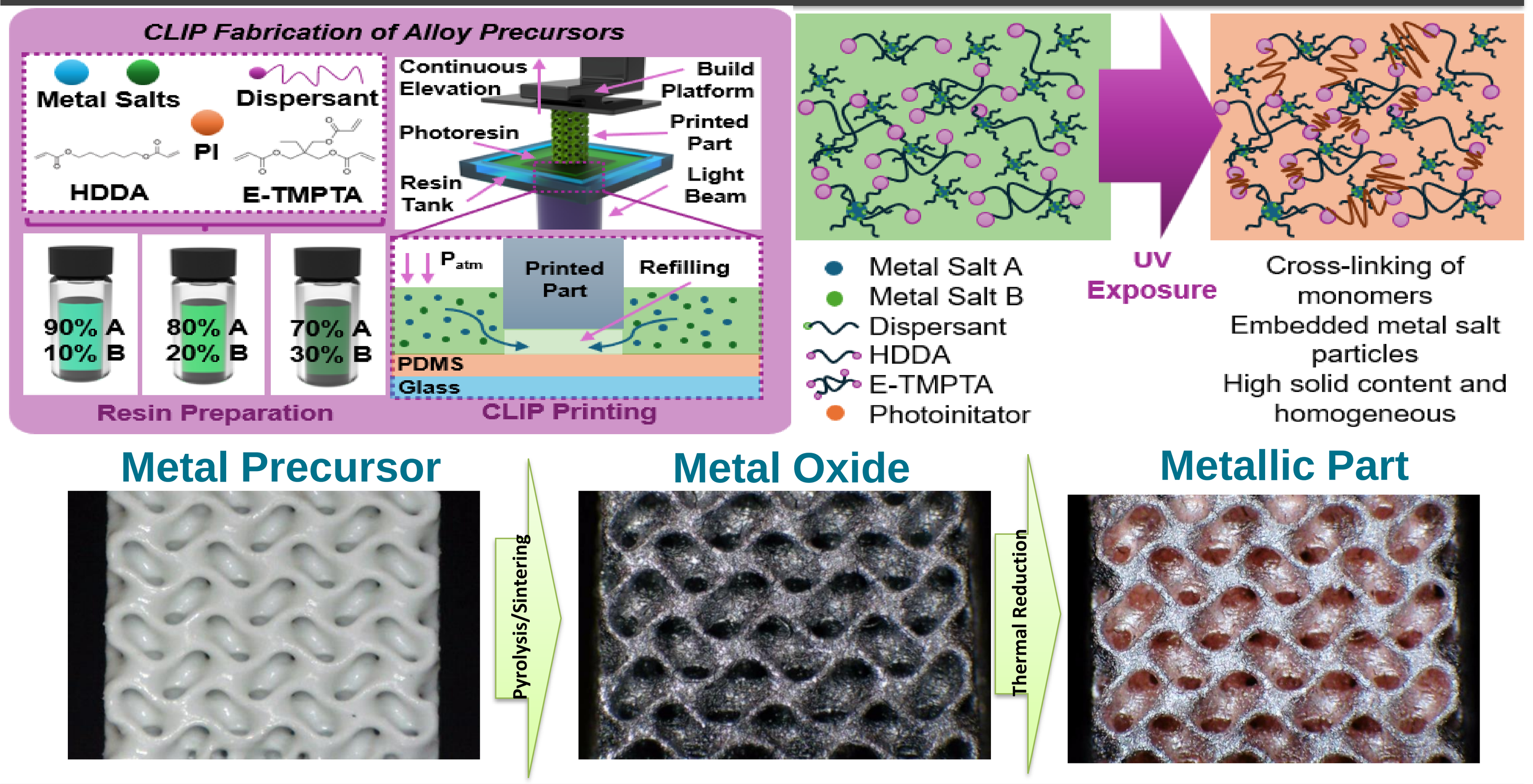
Recently, metal additive manufacturing (AM), also known as metal 3D printing has become an ideal technology for designing unique and intricate metal components that are difficult to achieve using conventional manufacturing methods. Powder bed fusion (PBF) and selective laser melting (SLM) are the two leading methods however due to the drawbacks of their processes employ distinct particle fusion mechanisms to produce metal parts in the form of melting or sintering. Metals printed through conventional AM technologies face major bottlenecks related to (1) poor surface roughness, (2) expensive equipment, (3) slow printing speed, and (4) anisotropic properties.

All are examples of multi-metal prints however the right image was created with PBF and is shown to have a poor surface roughness.

2. Abstract

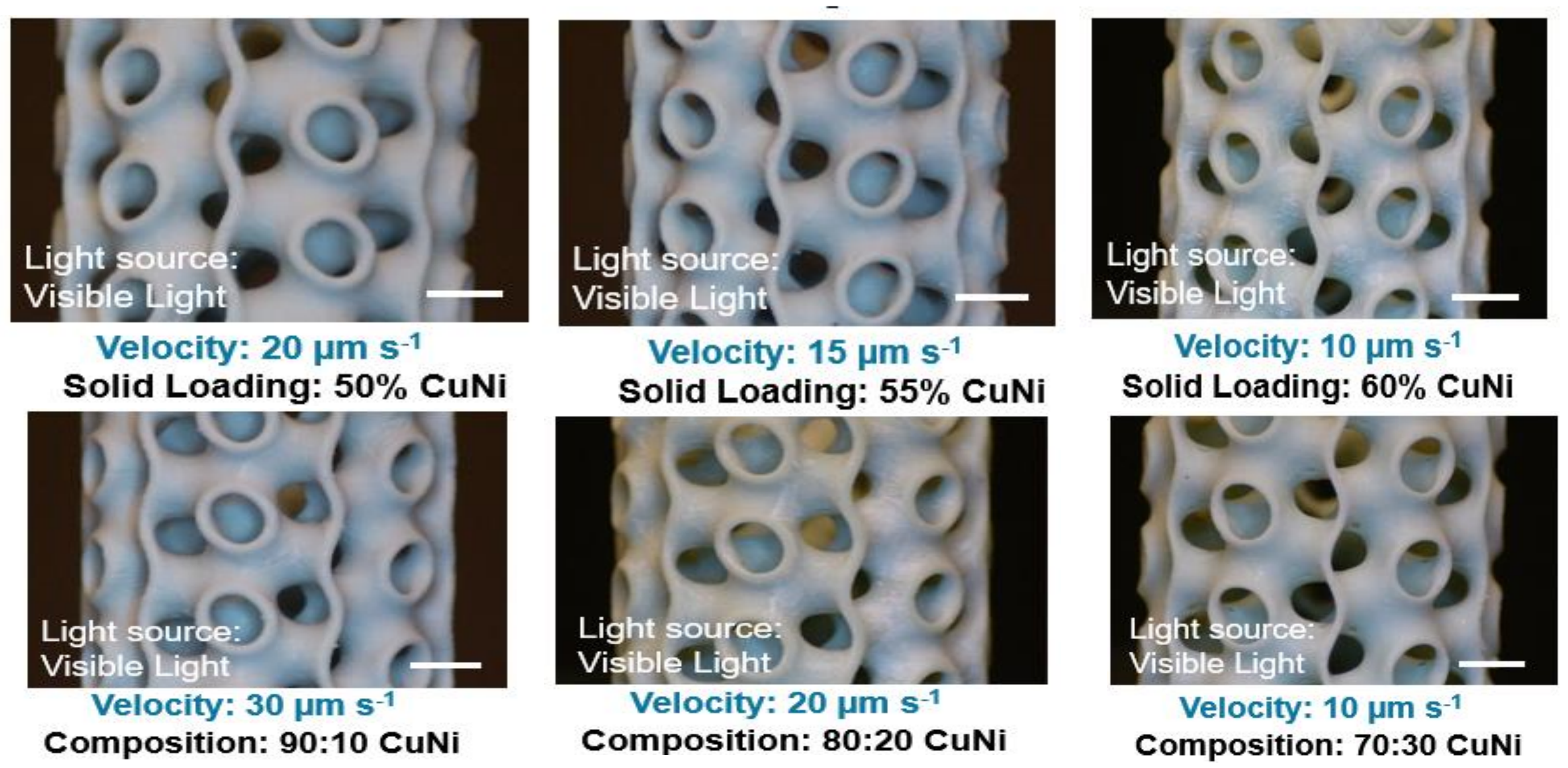
Mask image-based vat photopolymerization 3D printing, which selectively cures photoreactive resin, is an ideal technology for fabricating alloy objects by using an alloy-based resin. The objective of this project is to determine the characteristics associated with different solid loading profiles as well as different alloy compositions.

3. Fabrication Overview of Multi-Metal Structures



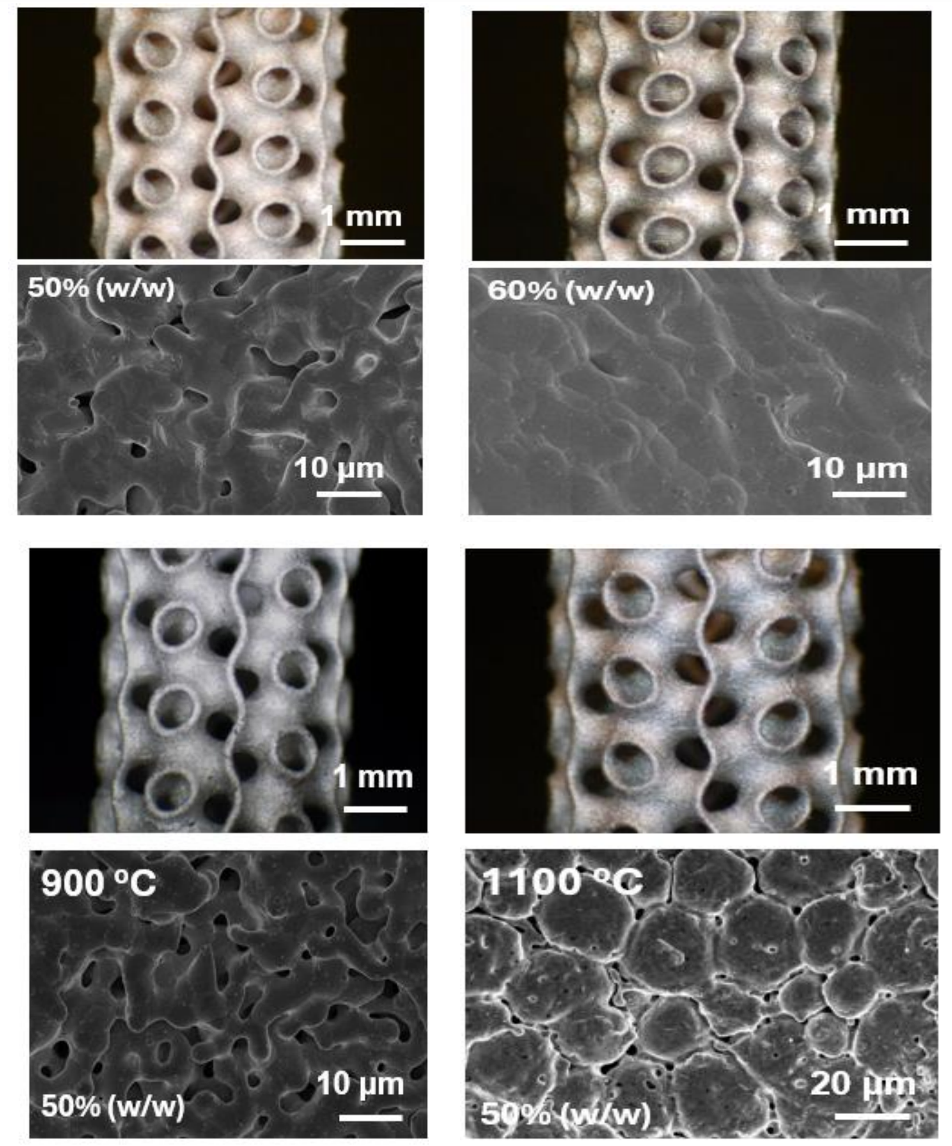
4. Solid Loading and Alloy Composition

Increasing the solid loading or a higher percentage of another metal leads to longer curing times. This impacts the print quality and requires slower printing speeds to achieve the same surface roughness.



5. Post Processing

The first row shows that with the increase in solid loading, the porosity of the part decreases. In the second row, increasing the sintering temperature increases the porosity of the printed part. These examples show how tunable the part properties are with sintering temperature or solid loading.



6. Future Work

1. Continue to document the properties of different alloy compositions

7. Acknowledgements

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8. References

1. Chao Wei, Luchao Liu, Yuchen Gu, Yihe Huang, Qian Chen, Zhaoqing Li, Lin Li, Multi-material additive-manufacturing of tungsten - copper alloy bimetallic structure with a stainless-steel interlayer and associated bonding mechanisms, Additive Manufacturing, Volume 50 ,2022, 102574, ISSN 2214-8604, https://doi.org/10.1016/j.addma.2021.102574

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