



Tech Snapshot Manufacturing

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ADDITIVE MANUFACTURING (AM) OF HARDENED TOOLING

*Rapid production of forming tools using
metal powder AM*



SUMMARY

Researchers at Los Alamos National Laboratory have developed a way to directly fabricate hardened tools through additive manufacturing methods. This offers several competitive advantages over traditional manufacturing by eliminating heat treating and post machining steps. This improves manufacturing processes and product performance. This technology allows tooling to be formed rapidly and iteratively. AM technology methods enables complex geometric designs and variations in material characteristics that can be tailored for hardness, strength and wear resistance. Los Alamos has tested prototypes in the lab and is seeking partners to license and test their technology in the field.



MARKET APPLICATION

The market for AM tooling is growing rapidly to produce tooling for a wide range of manufacturing applications. The global market for AM tooling is estimated to reach \$1.4 billion by 2024. This market is expected to grow in industries such as aerospace, automotive and medical, where the demand for complex and customized parts is high. AM offers the ability to produce highly complex shapes with greater accuracy and repeatability compared to traditional manufacturing methods. Overall, additive manufacturing of hardened tooling is gaining traction across various industries, with many companies recognizing the potential benefits of this technology for improving manufacturing processes and reducing costs.

BENEFITS

Direct fabrication of hardened tools by additive manufacturing offers several competitive advantages over traditional manufacturing methods.

- Customization: can be optimized for specific applications
- Reduced lead time: faster time-to-market and increased production efficiency
- Cost savings: reduces the need for multiple manufacturing steps
- Improved performance: longer tool life and reduced downtime
- Design flexibility: improved tool performance and functionality
- Sustainability: reduce waste and energy consumption in the tooling production process

CONTACT

Ross Muenchausen
rossm@lanl.gov
505-664-0558



WHY WE ARE BUILDING ADDITIVE MANUFACTURING (AM) OF HARDENED TOOLING

Los Alamos initially developed this fabrication method to improve the versatility in the Laboratory's forming shop, particularly in terms of forging and deep drawing of nuclear materials, ferrous alloys and refractory metals. It was determined that it could be a modern method of manufacturing for industry.



WHAT'S BEHIND OUR TECHNOLOGY

This technology uses additive manufacturing processes to produce hardened tooling—eliminating extra steps and costs associated with conventional manufacturing. In this method, the layer-by-layer addition of powder causes repetitive melting and recrystallization cycles which effectively mimic work hardening post annealing processes. Thus material, addition, densification and work hardening all occur in one step. Ultimately, this allows tooling to be designed, produced and hardened within a single process. It also allows for the same tool press-beds to be used repeatedly to recreate copies of tools in a rapid process that reduces operation downtime.



OUR COMPETITIVE ADVANTAGES

AM allows for rapid prototyping and production, reducing the time required to design and produce tooling. This can result in faster time-to-market and increased production efficiency. AM eliminates the need for expensive molds and fixtures, as well as reduces machining waste. It allows production of more complex geometries and decreases the risk of human error during the design stage.



OUR TECHNOLOGY STATUS

Los Alamos has utilized its expertise in work-hardened tooling requirements, knowledge of specialized equipment and development of software to rapidly build and evaluate prototype forming tools and evaluate process improvements by direct comparison to traditional machining and annealing methods. Los Alamos is discussing applications with aerospace, automotive and tooling suppliers and is now seeking partners to license and commercialize this technology.



PUBLICATIONS AND IP

Patent pending (S133801.001)