



3D Printed Case-Hardened and Industrial Die using BLDRmetal® L-40

CASE STUDY | Laser Powder Bed Fusion

Challenge

Tooling for Threading Bolts that Resist Self-Loosening

Fasteners that release when used in high vibration environments such as found in heavy equipment engine compartments or bridge structures increase maintenance costs, jeopardize safety, and increase risk liability. Perfect Lock Bolt America, Inc. has designed new structural bolts with an intricate thread design that would alleviate these concerns by resisting self-loosening.

In order to cost effectively produce these high-tech bolts, the process for making the dies used to forge the threads had to be completely revised.

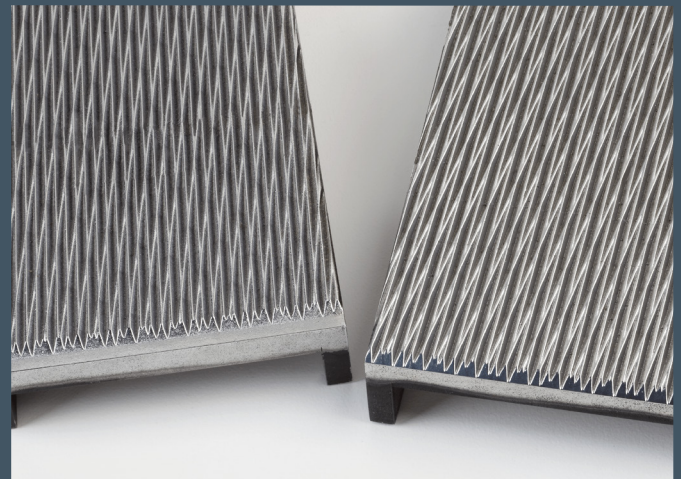
The conventional solution, machined D2 or M2 tool steel was unsuccessful in manufacturing – the complex die surface profile was extremely difficult to machine and when had a very short production run life. tested produced only limited bolts before failure. The team recognized the need to look at additive manufacturing as an alternate solutions. However, their concerns were two fold: 1) Were there any materials available hard enough to create the thread profiles but resilient enough to accomodate serial bolt production and 2) Could those materials be demonstrated to work in 3D printing in the application?

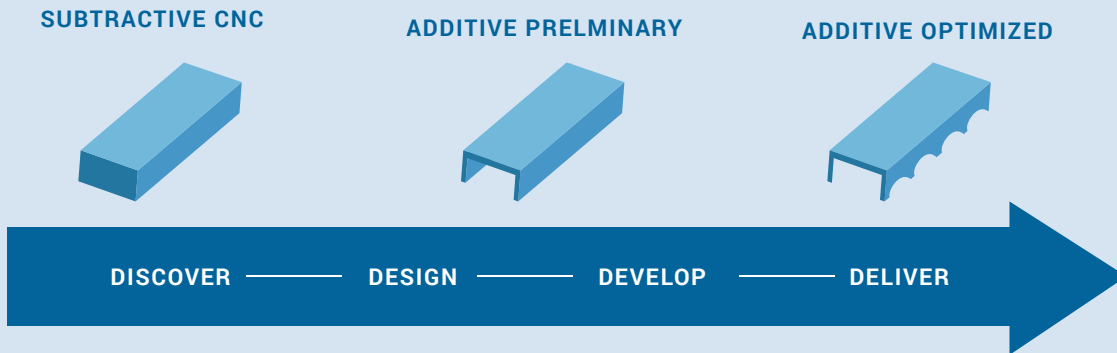
Solution

Formetrix Powder Bed Fusion 3D Printed Dies

Perfect Lock Bolt partnered with NanoSteel from the conception of the problem through to the final solution. In the alloy selection phase, Formetrix's BLDRmetal™ L-40 steel powder was proven to demonstrate the needed performance in hardness and durability. In cooperation with production partner CFK GmbH in Kriftel, Germany, the team optimized the printing process and parameters to meet dimensional and surface tolerances. Achieving this required that the roll thread dies, measuring approximately 20 cm (~8in), be redesigned in several iterations. In addition, Formetrix identified the post-production process to raise the surface hardness to 70 HRC and provide a surface finish with Ra of approximately 2-3 micron.

High Hardness Forging Die for Bolt Threading





Results

Successful Testing in a Production Environment

Formetrix recognized the opportunity to create what may be the first-of-its-kind 3D printed forging die. The resulting demonstration dies outperformed dies machined from D2 and M2 tool steels, successfully produced the fasteners.

“We tried nearly every combination of material and conventional CNC machining process to create our dual-thread die sets, none of which could cut or grind the complicated dual-thread geometry of our thread form,” said Mark Doll, President and CEO of Perfect Lock Bolt America Inc. “The Formetrix solution delivers exactly what we are looking for, including excellent surface finish, flexibility, as well as strength and hardness for maximum die life. This is a welcomed technological innovation to the fastener industry. We have been pleased with our testing and are slated to start production in 2017.”



Optimized Die Set After Printing

Benefits of 3D Printing:

Design and Manufacturing Freedom

- Full customization capability
- On demand just-in-time production
- Fast turnaround with rapid design iteration
- Enable parts consolidation

Benefits of BLDRmetal® L-40:

- Case Hardening: Up to 74 HRC
- High Core Properties:
 - Hard: >50 HRC
 - Ductile: >10% Elongation
 - Tough: 65J (v-notch, as built)
- Easy to Print (RT to 200°C)



Dual-Thread Bolt From Validation Trial

Disclaimer | Information is subject to change, please contact Formetrix for the latest information.