

# Additively Manufactured Mechanical Metamaterials for Improving EGS Survivability in the Downhole Environment

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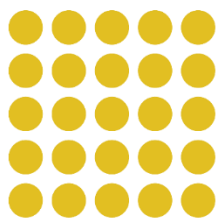
## We make *mechanical metamaterials*

Instead of creating new materials through chemical or molecular engineering, we design geometric patterns to enhance performance of conventional materials



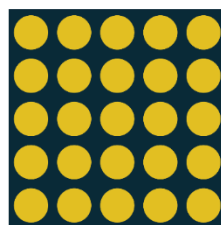
Conventional material

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Geometric pattern

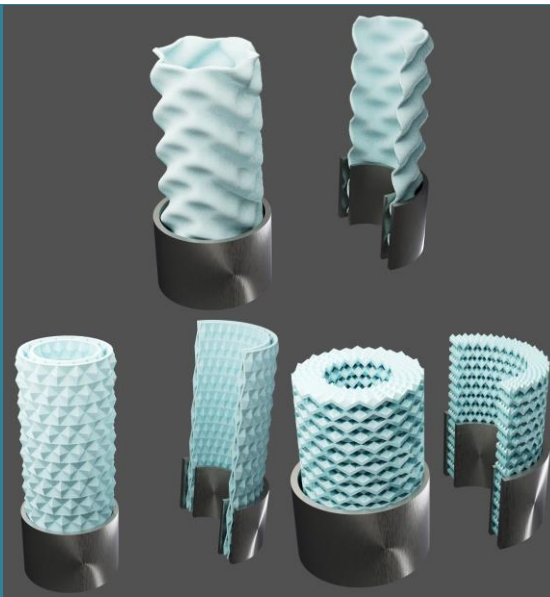
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Metamaterial

## 2. Our Solution

Additively manufacturing steel and Inconel tubular components with interior metamaterial geometries increases the buckling threshold ~40%, improves fatigue resistance in EGS, reduces failure rates, and mitigates costly downtime



## 1. The Problem

Enhanced Geothermal Systems (EGS) exposes drilling and well development equipment to extremely harsh conditions that increase failure and drive costs



Before Downhole



After Downhole

Images courtesy of Prof. John McLennon, Lead Reservoir Manager Utah FORGE

## 3. Why Us?

The proposing team has a *track record of success* developing commercial applications of metamaterial technologies



- \$1.5 Mn in equity-free seed funds
- USPTO 63/044646
- Full-time staff of 5
- 2,300 sq-ft facility
- Unique equipment for EGS equipment R/R&D
- Synergistic applications in aerospace, defense, and transportation
- Native DfAM technology