



# NITINOL

For Additive Manufacturing

**SHAPE MEMORY AND SUPERELASTICITY  
FOR LARGE-SCALE PRODUCTION OF NITINOL  
MEDICAL DEVICES**

MEDICAL IMPLANT  
ALLOYS



# Nitinol

Additive manufacturing of Nitinol allows the fabrication of complex device geometries with pre-designed porosity, homogeneous composition, high density, near net shape, and requiring very little or no post-processing. As Nitinol exhibits work hardening in conventional manufacturing processes, additive manufacturing presents unique opportunities in the production of medical devices.

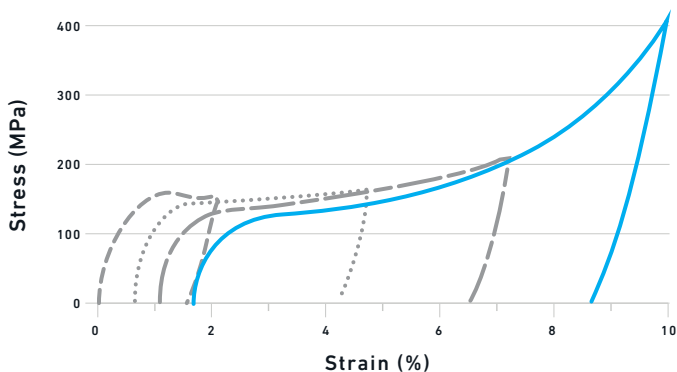
- Good superelasticity
- Shape memory effect
- Low stiffness
- Damping
- Biocompatible
- Corrosion-resistant

## Empowering consistent, high-quality device production

Finished Nitinol medical device properties are extremely sensitive to chemical composition and production thermal gradients. Subtle changes in chemistry and heat treatment can lead to large variations in austenite finish ( $A_f$ ) temperatures of the finished component. Effective translation of material properties from wrought to additive manufacturing is essential to enable large-scale production of 3D printed Nitinol devices.

Carpenter Additive offers EIGA (Electrode Induction Gas Atomization) Nitinol powder production that maintains high nickel levels during atomization. Used in-house by our additive experts who tailor the process to targeted properties, up to 6% of shape memory strain recovery has been demonstrated and 3D printed bone staples with shape memory effect have been produced.

### NITINOL STRESS STRAIN CURVES UNDER CYCLIC SHAPE MEMORY TEST

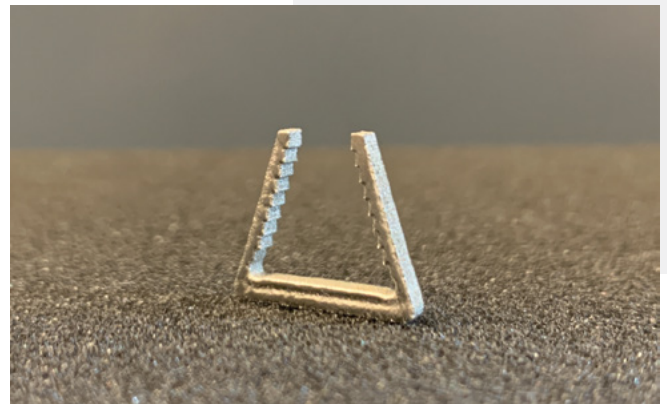


### Nitinol additive manufacturing solution:

- Provides stringent control of Nitinol chemistry throughout the additive lifecycle, from powder to finished part.
- Optimizes printing parameter sets to enable effective control over shape memory and superelastic properties.
- Delivers fully dense, near net shape Nitinol components to eliminate additional post-processing steps.

### Nitinol applications include:

- Cardiology stents and guidewires
- Orthodontic archwires
- Implantable orthopedic devices
- Bone staples



### NITINOL APPLIED AND RECOVERABLE STRAIN

