

Fast Response Shape Memory Effect Titanium Nickel (TiNi) Foam Torque Tubes

High-speed, high-torque torsional actuators for aerospace applications

Shape Change Technologies has developed a process to manufacture net-shaped TiNi foam torque tubes that demonstrate the shape memory effect. The torque tubes dramatically reduce response time by a factor of 10. This Phase II project matured the actuator technology by rigorously characterizing the process to optimize the quality of the TiNi and developing a set of metrics to provide ISO 9002 quality assurance. A laboratory virtual instrument engineering workbench (LabVIEW™)-based, real-time control of the torsional actuators was developed. These actuators were developed with The Boeing Company for aerospace applications.

Applications

NASA

- ▶ “Morphing” unmanned aerial vehicles (UAVs)
- ▶ Concept vehicles:
 - Using wing twist to control flexible wing structures
- ▶ Deployment of booms:
 - Deploying sensors in aircraft and/or in spacecraft where the lightweight, minimal part count actuators could be heated electrically
- ▶ Next-generation shuttles (actuators must also be space qualified):
 - Controlling wing twist, nacelle structures, or ancillary aircraft structures

Commercial

- ▶ Aviation:
 - Controlling variable nacelle structures
- ▶ Windmills and turbines:
 - Generating energy more efficiently
- ▶ Health care:
 - Assisting the disabled as a lift device (similar to hydraulic actuators but with less bulk)



Phase II Objectives

- ▶ With Boeing:
 - Optimize materials to reduce contamination
 - Develop ISO 9002 production standards
 - Develop high-speed, high-torque torsional actuators
- ▶ Fully characterize the materials mechanically and chemically during production to minimize oxide/hydride contamination
- ▶ Develop LabVIEW-based computer-controlled actuation for on-off and proportional control
- ▶ Develop infrastructure to support batch production of actuators
- ▶ Test actuators (Boeing provides in its testbed facility)

Benefits

- ▶ Large torque
- ▶ Fast response
- ▶ More aerodynamically efficient structures

Firm Contact

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