Shape Memory and Pseudoelastic Ceramics
Technology #15550

Applications

Shape memory and pseudoelastic ceramics have applications in actuators, couplings, armor materials, and biomedical devices.

Problem Addressed

Previous ceramic shape memory materials are polycrystalline, and during the shape memory effect, or pseudoelastic loading, the grains may change shape in opposing directions causing internal stress concentrations. This invention utilizes single crystal ceramic materials to overcome the stress concentrations found in polycrystalline materials.

Technology

Ceria-doped zirconia is one ceramic material investigated. The material is made into a powder through a co-precipitation technique. The powder is uniaxially pressed into disks and then sintered at 1500°C. The grain size is proportional to the sintering time (i.e. longer sintering time leads to larger grains). After sintering, single crystal pillars are made using focused ion beam (FIB) milling on individual grains. The resulting single crystal materials are able to undergo the phase transformations without cracking.

Advantages

- Ability to repeatedly undergo shape changing phase transformation without cracking or fracture
- Ceramic shape memory and pseudoelastic materials

Related Technology

Shape Memory and Pseudoelastic Ceramics is connected to Electrically Activated Shape Memory Ceramics, Case Number 16618.

Categories For This Invention:

Materials
Micro & Nanotech
Shape Memory Alloy Structures
Medical Devices
Robotics
Actuators
Shape-memory Effect Actuators
**Life Sciences**  
**Biomaterials**  
**Ceramics**

**Intellectual Property:**
Ceramic Structures for Enhanced Shape Memory and Pseudoelastic Effects  
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9,018,117

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**Publications:**
Shape Memory and Superelastic Ceramics at Small Scales  
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**External Links:**
Schuh Group  
https://schuh.mit.edu/

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