

Magnetorheological elastomers

General features

Magnetorheological elastomers (MRE) are composite materials that consist of magnetizable particles embedded in an elastomeric Matrix. They exhibit two mechanical effects when a magnetic field is applied: (1) Reversible stiffening and (2) Actuation.

Applications

- Adaptive vibration damping
- Soft actuators
- Haptic interfaces
- Adaptive sealings

Properties

- Simply to mold into arbitrary shapes
- The preferred elastomer material is silicone rubber.
- Young's modulus between 10 kPa and 1 MPa
- Stiffening upon exposure to magnetic field with increase factor of storage modulus up to 1000
- Shape-memory effect when removing the magnetic field
- Actuation strain up to 15 %
- Actuation force up to some 10 N depending on dimensions
- MRE are durable and stable while cycling (> 100.000 cycles)
- Adjustable rheological and magnetic properties according to customer's demand

Characterization methods

- B-Sweep i. e. storage and loss modulus in dependence of the magnetic flux density
- Young's modulus in the pristine state through stress-strain experiments
- Actuation strain and stress