Magnetoelectric behavior of rare earth based intermetallics in high magnetic fields up to 33 T

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**Magnetostriiction in high magnetic fields**

**Experimental methods**

- X-ray or neutron diffraction (spontaneous effects, H-const., sensitivity 10\textsuperscript{4})
- Extensometers (using strain gauges, spontaneous and field induced effects, successfully tested in pulsed fields, sensitivity 10\textsuperscript{5})
- Interferometry (spontaneous effects, H-const., sensitivity 10\textsuperscript{7})
- Capacitive dilatometer (spontaneous and field induced effects, sensitivity 10\textsuperscript{4} - 10\textsuperscript{5})

**The capacitive miniature-dilatometer**

- Measures thermal expansion at H-const. and magnetostriiction at T-const. with a resolution of 10\textsuperscript{-7} (in supercond. magnets)
- Uses a tilted plate capacitor made from Ag
- Has small dimensions: diameter d=22mm, height h=40mm
- Measuring range of about 10\textsuperscript{-4} to 10\textsuperscript{-3} %

**Magnetostriiction measurements in resistive magnets**

- Noise levels in BITTER-magnets are low and practically only limited by magnetic field fluctuations.

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**Rare earth intermetallics ... RCu\textsubscript{2}**

**Model of magnetostriiction**

The RCu\textsubscript{2} compounds magnetostriiction result from

- The single ion crystal field (CEF) contribution and
- The two ion exchange intertaction.

The elastic constants – important for applications - can be calculated.

**Summary**

- Magnetostriiction measurements are a powerful tool to study the magnetostriective Interactions and magnetic phase transitions.
- The magnetostriective behavior can be calculated using a theoretical model which takes into account the crystal field striction as well as the exchange striction.
- Magnetostriective measurements in resistive, water cooled high field magnets give good results. The resolution is still limited to 10\textsuperscript{-4} by mechanical vibrations.

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