**ABSTRACT**

- Single crystalline magnesium oxide (MgO) nanowires have been grown on (001)-oriented MgO substrate using the vapor-liquid-solid (VLS) growth mechanism for use as an inert template. The pulsed laser deposition technique is employed to grow ‘core/shell’ coaxial heterostructures of functional materials, such as ferroelectric and/or ferromagnetic oxides, encapsulating the MgO nanowire template. These nanosctructured multiferroic nanowires are attractive for next-generation applications, including miniaturize magneto-electric memory, magnetic field sensors, electrically controlled magnetic devices, and magnetically controlled piezoelectric devices.

**What is Multiferroic?**

- **Magnetoelectric effect** is defined as the variation of the dielectric polarization response under an applied magnetic field, or the presence of an induced magnetization under an external electric field.
- **Multiferroic has two or more** of the primary ferroic properties within a single material or an heterostructure.

**Nanowire-Based Multiferroic Structures?**

- Magnetoelectric effect in a multiferroic thin film bilayer is substantially reduced due to clamping effect of the substrate.
- A nanowire template can minimize the clamping effect.
- Further, by etching away the template material (e.g., MgO), an unclamped nanotube geometry can be fabricated exhibiting enhanced magnetoelectric effect.
- Fabrication of novel nano devices using nanowire-based magnetoelectric (ME) material.

**Future Plans**

- Characterization of electric, magnetic and magnetoelectric properties of nanowire-based heterostructures.
- AFM characterization/ Magnetic properties of nanowires.
- Electrical and magnetoelectric measurements.
- Fabrication of nano devices with nanowire-based ME structures.

**Conclusion**

- MgO nanowires have been successfully synthesized for use as an inert template.
- Ferroic materials have been coated on the MgO nanowires using PLD.
- A single MgO nanowire has been manipulated and placed on the electrical contact pads for magnetoelectric measurements.

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**References**

- [Kim, Gunwoo et al. (2005)](https://doi.org/10.1021/nm048214b) - Nanowire growth and characterization.
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