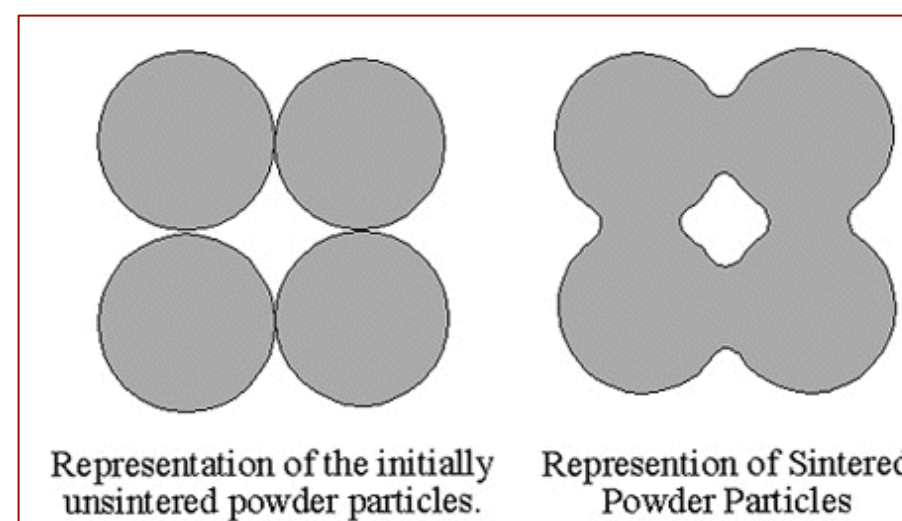


Abstract

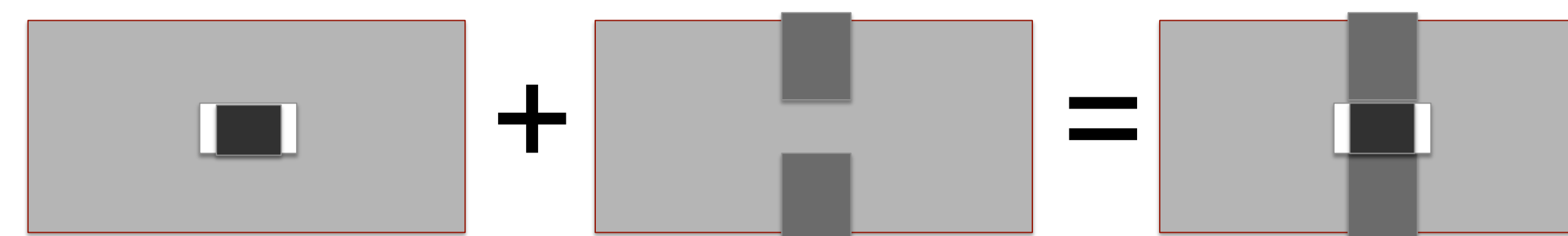
The objective of this study was to utilize a solid-state reaction technique to synthesize bulk samples and “thick” powder films of $\text{La}_{0.4}(\text{Ca}_{0.4}\text{Sr}_{0.2})\text{MnO}_3$ in order to investigate their structural, electron transport, and microwave absorption properties. In the synthesis process, stoichiometric amounts of high purity lanthanum oxide, calcium carbonate, strontium carbonate, and manganese dioxide were combined, and the resulting powder was ground, calcined, and sintered, in air. The resulting compound in a variety of geometries was structurally characterized using XRD to check the crystal structure. The electrical resistance and magnetoresistance were measured, and microwave absorption was also carried out. The hypothesis was that magnetic field exposure to the bulk samples and powder films would cause a decrease in electrical resistance.

Introduction

- LaMnO_3 is a ceramic that has a perovskite crystal structure. Doping with some alkaline earths (e.g., Ca, Sr) results in
 - insulating/metallic transitions
 - colossal magnetoresistance
 - Changes in the electrical conductivity
- Calcination
 - Removes CO_2 and excess O_2
- Sintering
 - Pressure and heat to form a solid mass
 - Atoms diffuse across the boundaries of the particles, fusing the particle together and creating one solid piece



Methods (Thick Film)

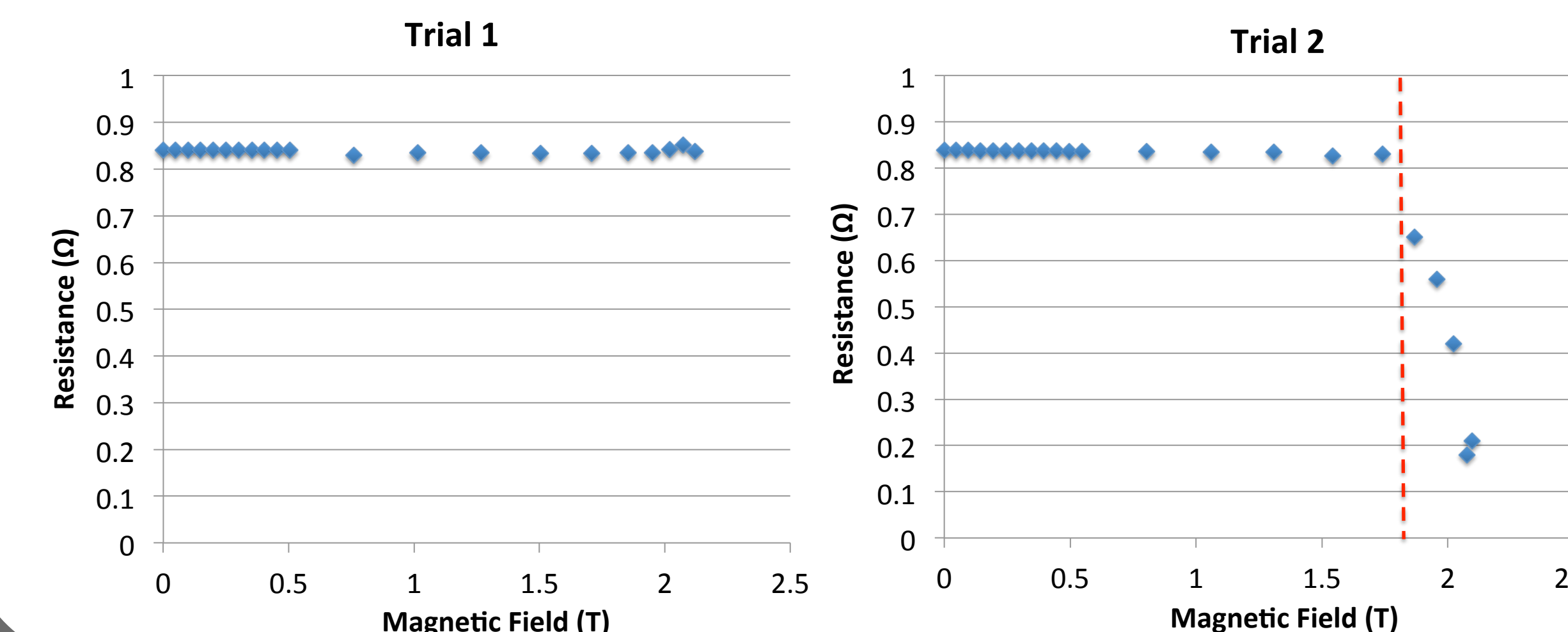


**The resistance continued to drop as the silver paint dried.

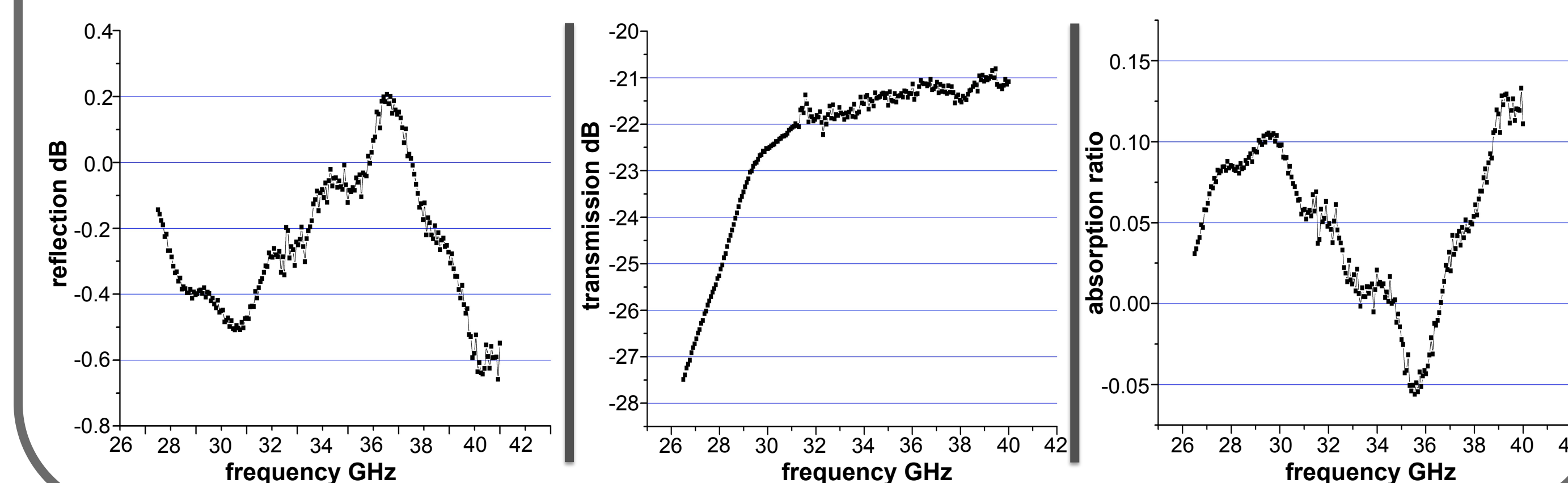
Sample Dimensions	Measurement (mm)
Length	5.33
Width	2.54
Thickness	0.30

- Glass slide
- Clear nail polish
- Grinded, sintered powder sample
- Silver paint

Results (Magnetoresistance)

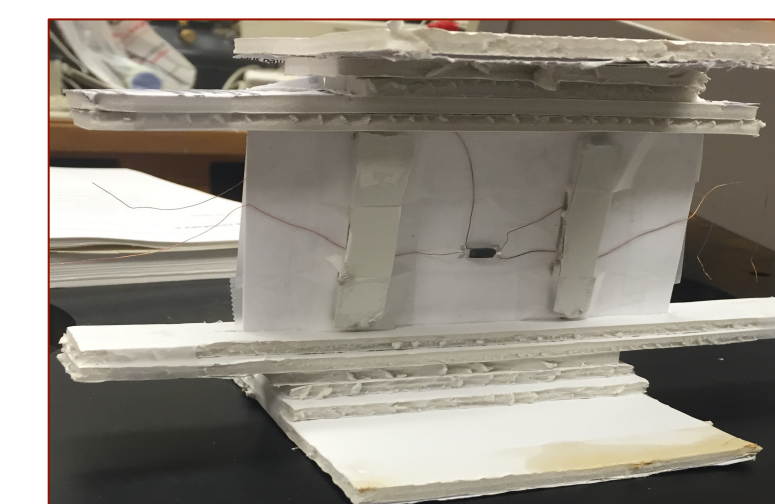
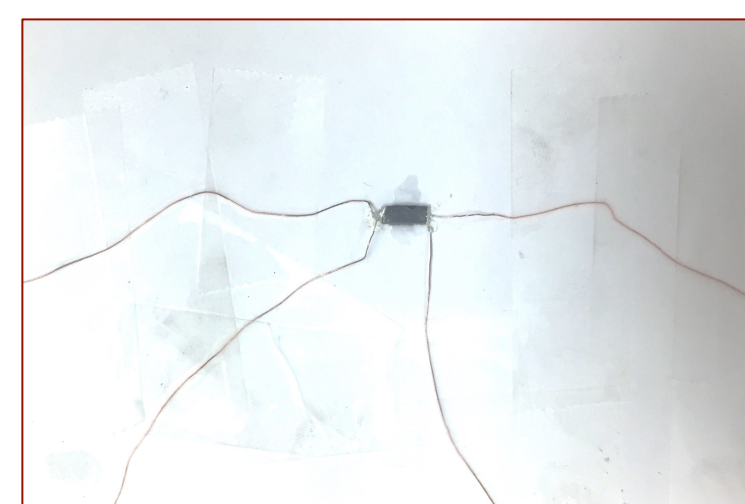


Results (Microwave Absorption)

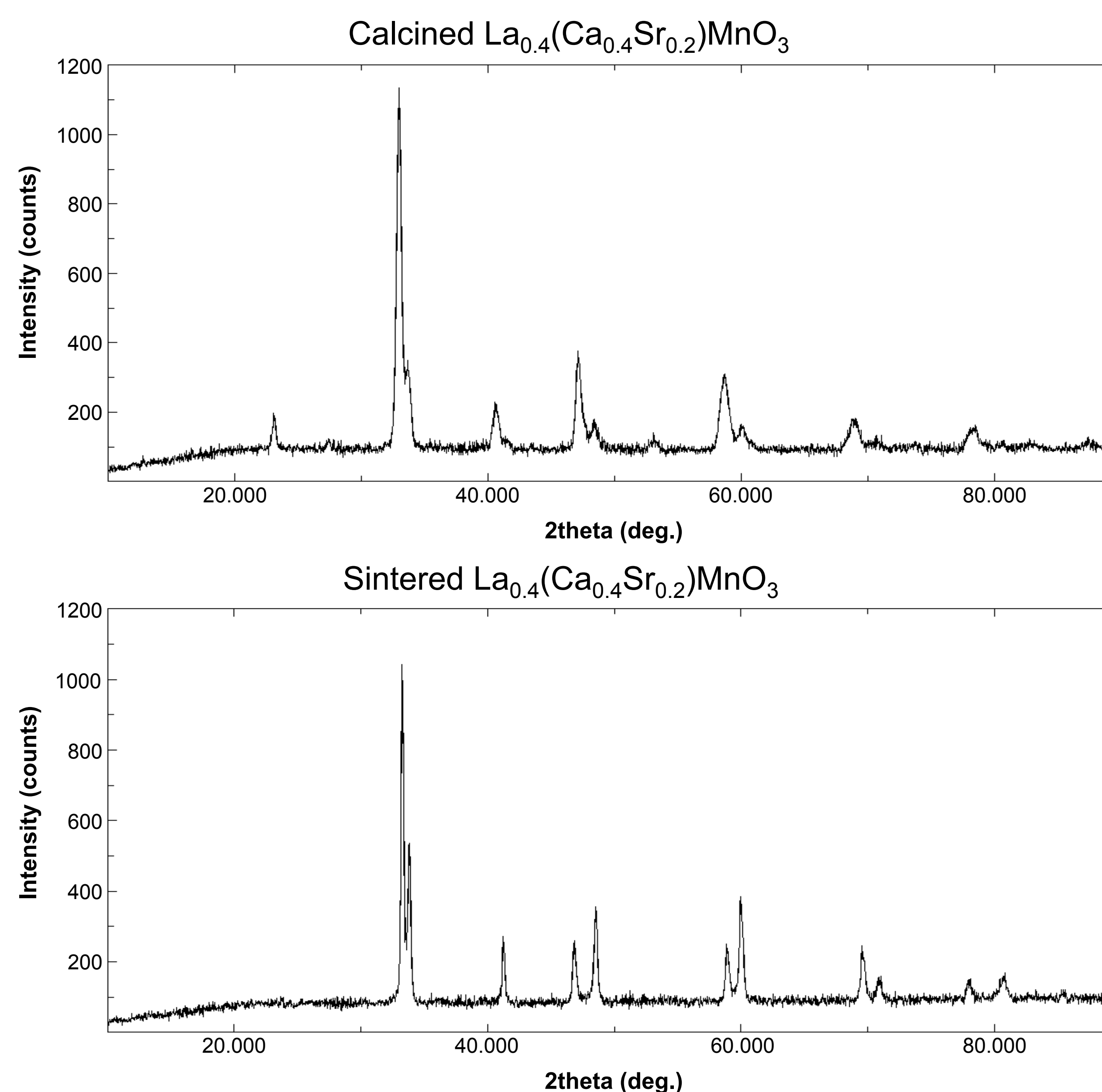


Analysis

1. X-ray diffraction
2. Four-probe method
 - Electrical resistance
 - Magnetoresistance
3. Microwave absorption



Results (XRD)



Conclusion

The synthesized material was hard, shiny, and slightly magnetic. The two trials disproved the hypothesis that increasing the magnetic field would cause a decrease in electrical resistance. Both trials neither had a decrease nor increase in resistance. Since the copper wires were connected to metal clips, they moved as the magnetic field was increased. The resistance changed when the wires moved, so that could explain the erratic resistance. The next step would be to use leads on the four-probe and tape the clips further away from the magnets. Future work would be to expose the sample to varying temperatures and ultraviolet rays, and then check the magnetoresistance. The resistance of the thick powder film should also be checked.

References

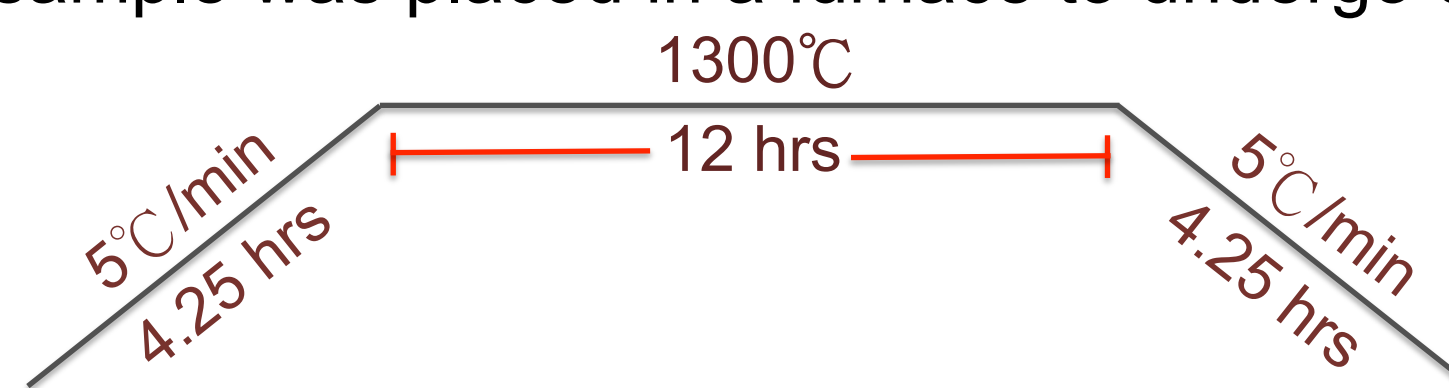
- Gilibert, A.; Cauro, R.; Contour, J.P.; Medici, M.G.; Grenet, J.C.; Papiernik, R.; Schuller, Ivan K. "Effects of illumination on the electrical properties of oxygen deficient cuprates and manganites." (2000). Journal Title: Superconducting and related oxides, physics and nanoengineering IV, 331-7, 4058.
- Kornfield, M.C.; Wicker, S.; Henry, L.L. "Synthesis and structural characterization of $\text{La}_x\text{Ca}_{2-x}\text{Sr}_2\text{MnO}_3$."
- Pyle, Logan; Kornfield, Matthew; Henry, L.L. "Toward the Development of a Proposal to Study the Effects of UV Radiation on some La(Sr/Ca)MnO Compounds." Proceedings of Louisiana EPSCoR RII La-SIGMA 2013 Symposium.
- Raziano, William; Franklin, Jermain; Henry, Larry. "Ultraviolet Radiation effects on the electrical resistivity of some La(Ca/Sr)MnO materials." Proceedings of Louisiana EPSCoR RII La-SIGMA 2014 Symposium.

Acknowledgements

This work was funded by the Louisiana Board of Regents, through LASIGMA [Award Nos. EPS-1003897, NSF (2010-15)-RII-SUBR, and HRD-1002541].

Methods (Bulk Sample)

- Synthesis: Mix constituent compounds
- Stoichiometric amounts of the compounds were mixed and ground.
 - La_2O_3 : 2.1 g
 - CaCO_3 : 1.0 g
 - MnO_2 : 2.8 g
 - SrCO_3 : 1.3 g
- The powder sample was placed in a furnace to undergo calcination in air.



- The powder was taken out of the furnace and re-ground.
- X-ray diffraction was ran on the calcined sample.
- The calcined sample was pressed (1500 kPa) and reheated in the furnace to undergo sintering.

