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Understanding Multi-Functional Materials Through Preparation and Characterization of Formate Perovskites

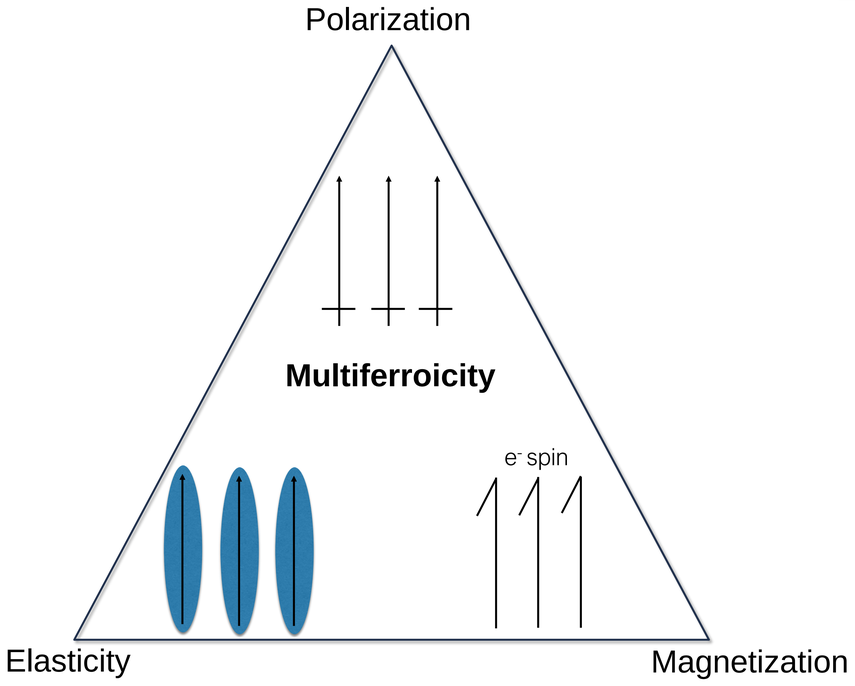
Andrew Hope, Eve Mozur

Metallurgical and Materials Engineering

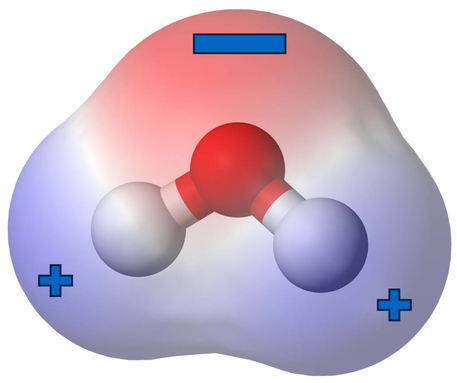
COLORADOCENTERFORADVANCEDCERAMICS CCAC COLORADOSCHOOLOFMINES

Multifunctional materials have coupled magnetic and electric properties.

Materials with coupled electric and magnetic responses have promising applications.



It is challenging to get both electric and magnetic responses in the same material.



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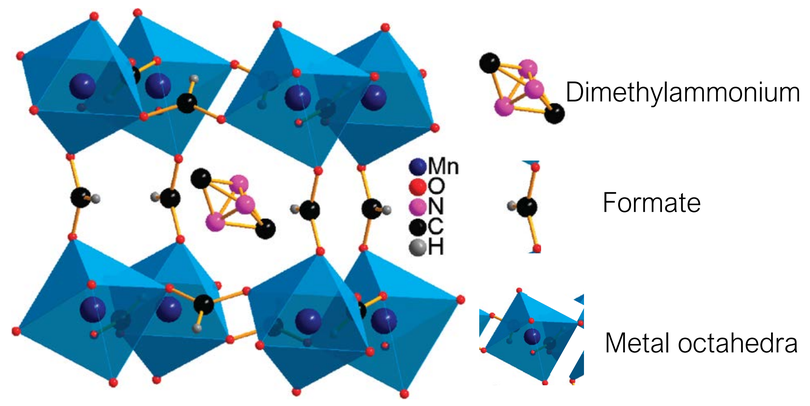
Mn $3d^5$ orbital: ↑ ↑ ↑ ↑ ↑

Different parts of the material have different functions.

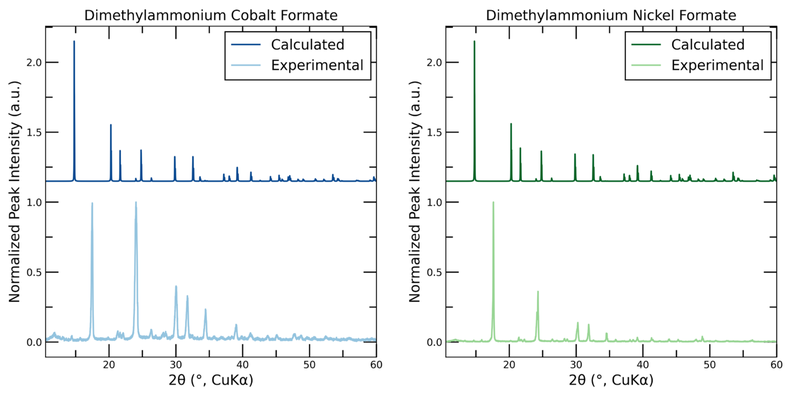
Hypothesis: Using hybrid-inorganic materials can solve this challenge.



Jain, et al. Journal of the American Chemical Society (2009)

Synthesis of these materials proves to be challenging.

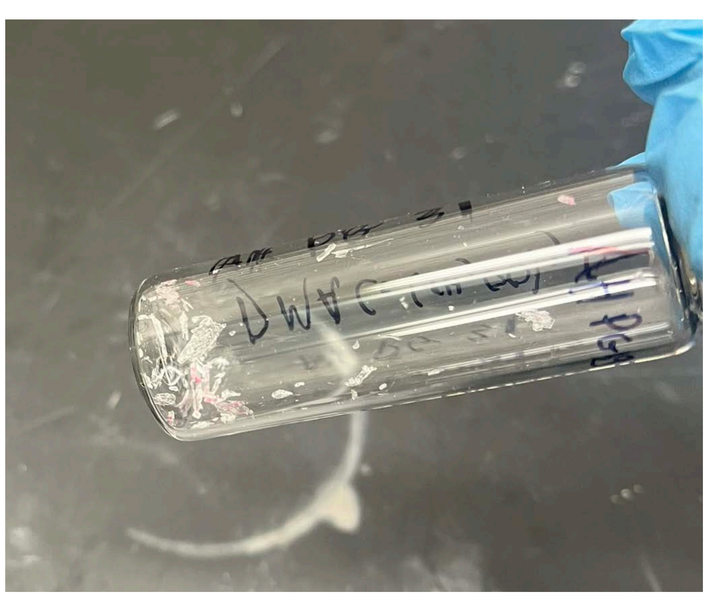
Alternate products are often produced.



The experimental x-ray diffraction (XRD) patterns do not match the expected patterns.

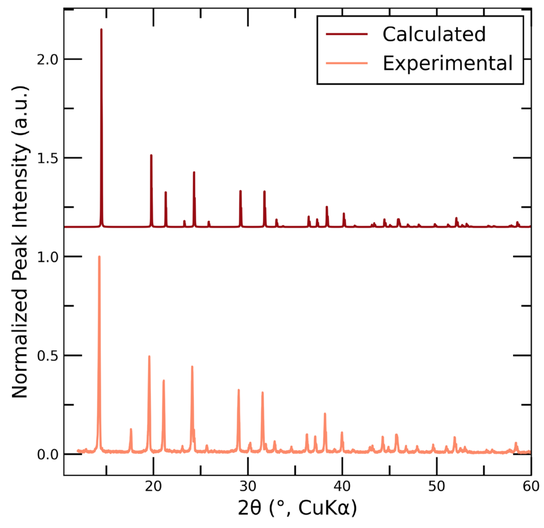
Calculated data from: Wang, et al. Inorg. Chem. (2004)

Synthesis of multifunctional materials take weeks and produce very little product.



Product from one synthesis procedure, not enough to preform XRD.

Successful synthesis of Dimethylammonium Manganese Formate

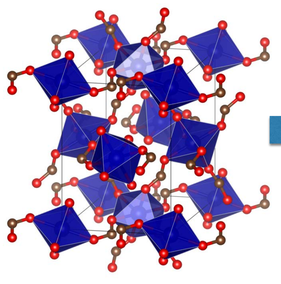


The experimental XRD pattern matches the expected pattern.

Calculated data from: Wang, et al. Inorg. Chem. (2004)

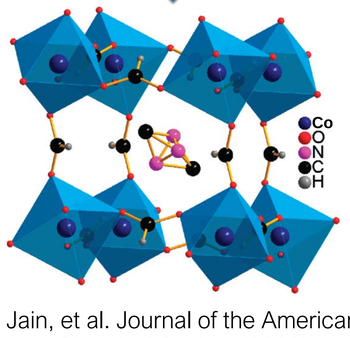
Troubleshooting the process towards developing structure-property relationships.

Extending the evaporation step may improve the synthesis of Dimethylammonium Cobalt Formate.



Antsyshkina, A.S. J Struct. Chem. (1967)

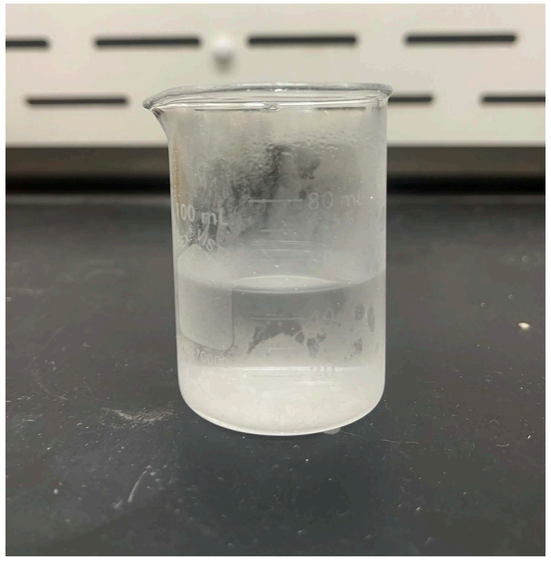
Evaporation



Jain, et al. Journal of the American Chemical Society (2009)

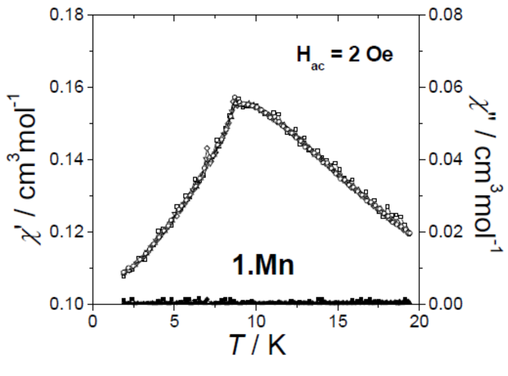
Slowing the evaporation time converts the Cobalt diformate dihydrate into the desired product.

Chilling the ethanol for the washing step could improve the yield of the product.

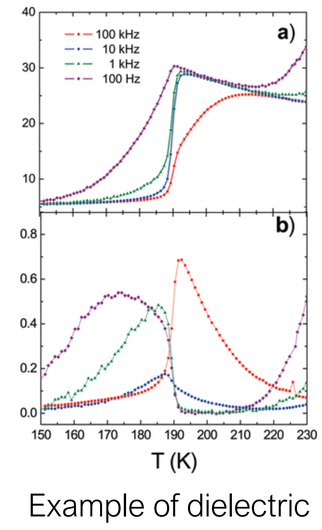


Ethanol chilled to 5°C.

Magnetometry and dielectric spectroscopy will allow for the development of structure-property relationships.



Example of magnetometry spectra from Wang, et al. Inorg. Chem. (2004)



Example of dielectric spectroscopy spectra from Sanchez-Andujar, et al. Inorg. Chem. (2004)