The Effect of Oxygen Isotope Substitution on Magnetism in Multiferroic $CaMn_7O_{12}$

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Multiferroic materials, where ferroelectricity and ferromagnetism coexist and interact and one property can be used to drive the other, can find potential applications in spintronics and information technology and form the basis for four-state memory. However the details of coupling between these two orders are not yet understood. Competing theories of inherent electronic structure [1] and ionic displacement [2] are proposed to explain this coupling, but no experimental evidence currently exists to differentiate these models.

To investigate the interaction between magnetic moments and electric dipoles on a fundamental level, this study will extend the isotopic pure oxygen substitution, a widely used technique for the investigation of high temperature superconductors [3], to multiferroics.

Single crystal $CaMn_7O_{12}$ showing the largest magnetically induced electric polarization measured to date [4] is chosen as a test material and synthesized by flux method. The preliminary results show that single crystals of a size ~100x100x100 μm can be obtained however a small amount of $CaMn_3O_6$ impurity phase is also detected in XRD. Efforts on growing a larger single crystal are under way.

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