SYNTHESIS OF $YFeO_3$ THROUGH OXIDE INTERMEDIATES

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Yttrium ferrite ($YFeO_3$) is a material which is attributed to the perovskite structure and exhibits unique magnetic and photocatalytic properties, which are dependent on the obtained crystal structure (orthorhombic or hexagonal). Due to the stability of orthorhombic $YFeO_3$, the material has been widely studied and can be easily synthesized via various methods. In comparison, hexagonal $YFeO_3$ exhibits more intriguing properties (i.e. ferroelectric and ferromagnetic coupling [1]), but it is metastable at room temperature. To overcome this, more complicated synthesis methods need to be used.

There are two main ways to counteract the metastability of the desired material, either through utilizing fast synthesis methods to obtain the kinetic product (ultra-fast high-temperature sintering) or via thermodynamically stable byproduct formation (cometathesis). The first option has become quite popular over the last few decades, although it is difficult to control and to get reproducible results due to high temperature fluctuations [2]. On the other hand, cometathesis reactions have to be tailored for easy removal of said byproducts from the final mixture. In this work, the obtained byproducts are water-soluble calcium and magnesium salts, which can be easily washed out. Depending on the Ca and Mg precursor ratios, the synthesis temperature can be manipulated quite effectively, regarding the desired results [3].

The main goal of this research - to synthesize the hexagonal $YFeO_3$ phase, using various oxide precursors ($MgFe_2O_4$, $CaFe_2O_4$ and YOCl) in different ratios and to elucidate the dependence of the obtained product phase purity and physical properties on the synthesis conditions.

This research encompasses the synthesis and characterization of the precursor materials, their use for the synthesis of $YFeO_3$ and analysis of the obtained product.

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