Hydrogen Production and Oxygen Storage Materials

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CPSP369G
College Park Scholars Academic Showcase, May 3, 2024

Introduction

For this project, I worked in an inorganic material's chemistry lab, where we studied the structure of metal oxide's that related to environmental preservation and fuel efficiencies.

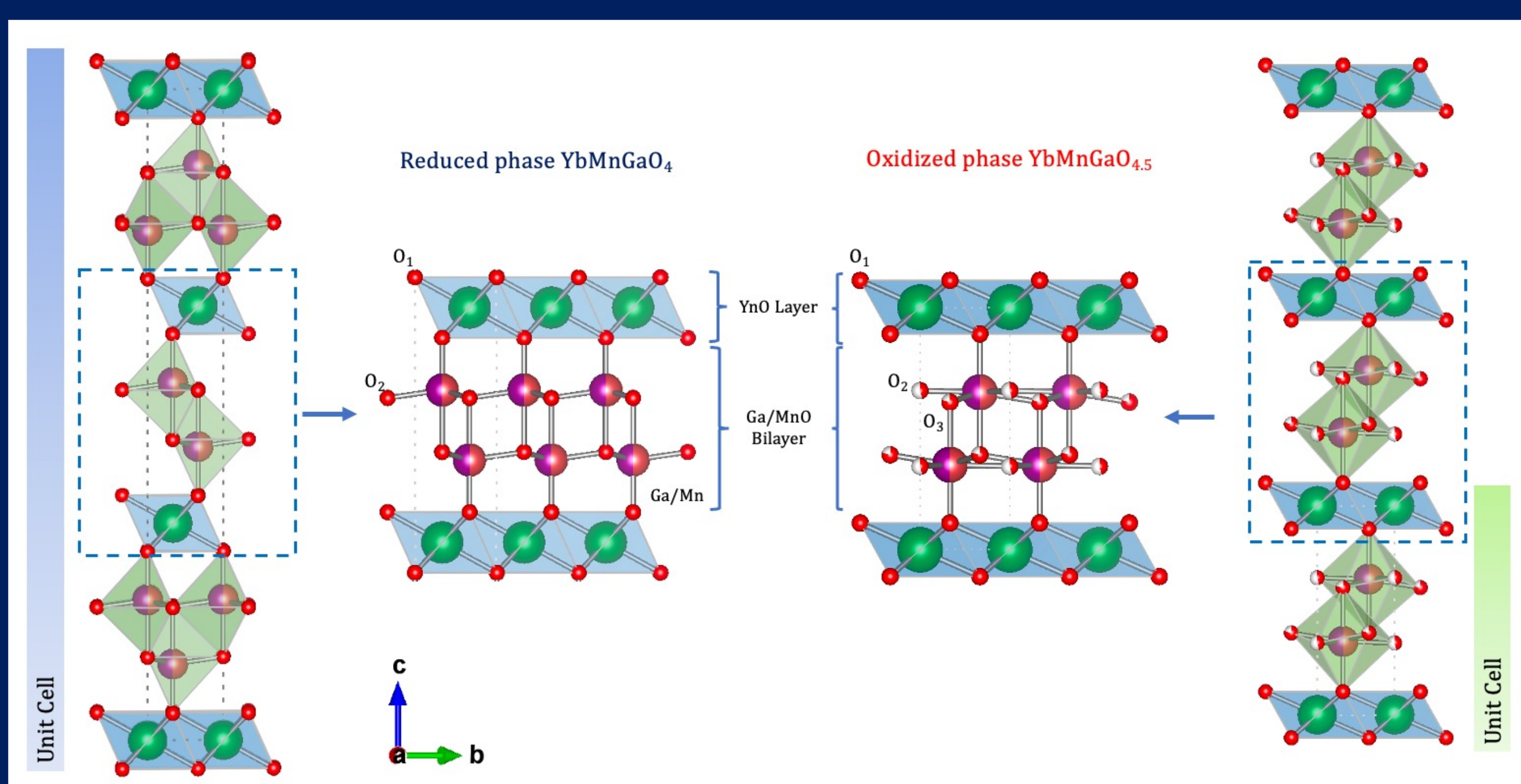

Figure 1: Unit cells of $YbMnGaO_4$ and its oxidized counterpart

Activities

In the lab, I synthesized and characterized metal oxides such as $LuMnGaO_4$, $LuFe_2O_4$, and $LuMnFeO_4$. The synthesis consisted of grinding up powders, vacuuming, sealing and heating to temperatures above 1100 °C.

I characterized the metal oxides by completing x-ray diffraction and thermogravimetric analysis.

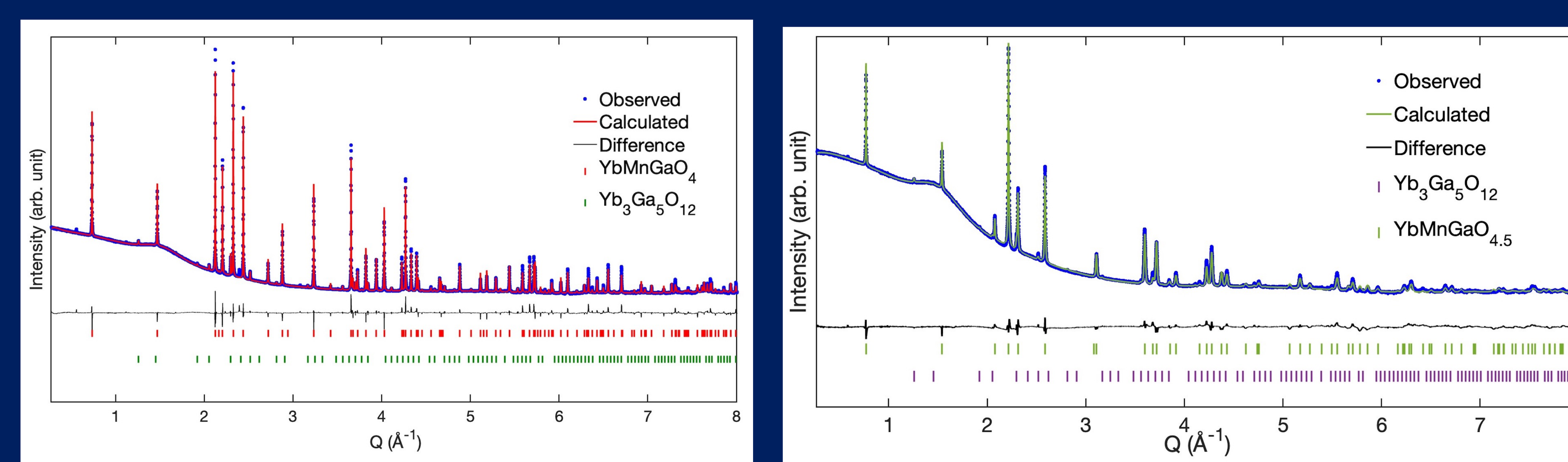

Figure 2: X-Ray diffraction pattern for $YbMnGaO_4$ and its oxidized counterpart $YbMnGaO_{4.5}$ (Left and right respectively)

Site Information

Name of Site: University of Maryland, College Park

Address: 8051 Regents Dr, College Park, MD 20742

My supervisors: Efrain Rodriguez and Stephanie Hong

The site mission: Discovery of materials that contribute to technological and environmental development.

The particular goal I am studying is the generation of green energy and oxygen storage materials.

Results/Impact

It was found that $LuMnGaO_4$ and $YbMnGaO_4$ were the best at intaking oxygen out of the series, meaning they are the best oxygen storage material.

This indicates that $LuMnGaO_4$ and $YbMnGaO_4$ are promising oxygen storage materials that could serve to create a more efficient system in fuel combustion and conversion.

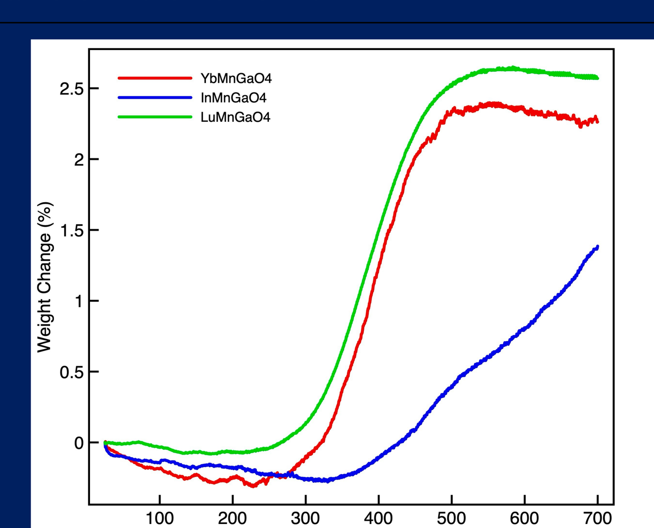

Figure 3: Thermogravimetric graph of the series of metal oxides: $InMnGaO_4$, $LuMnGaO_4$, and $YbMnGaO_4$.

Personal Statement

There were very little issues regarding the lab, or research as a whole. Stephanie, Dr. Rodriguez, and the rest of the group are amazing people that make the environment fun and enjoyable. The only issue was the machines would break down a lot or not work properly which would prevent us from characterizing or synthesizing.

Future Work

For the future, I would like to apply the solar thermochemical water splitting concept to the metal oxides to see which generates the most hydrogen effectively. Additionally, I would like to compare which metal oxide with the most production of hydrogen with that of the most efficient intake of oxygen to see if there is any correlated atomic features that contribute to both.

Acknowledgements

Stephanie Hong; Dr. Rodriguez; Dr. Holtz; Dr. Merck

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