

Synthesis of Cerium Oxides and Chalcogenides

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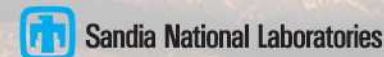
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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



Training

■ Sandia National Laboratories

- How to conduct oneself in a workplace

■ Advanced Materials Laboratory

- Safety
- How it Operates
- Procedures for Equipment
- Ordering Chemicals and Equipment
- Inventory



What is a Nanometer?

- One billionth of a meter in size
- Size-related properties
- Applications for medical, electronic and industrial uses
- Man made and in nature

Macrosize

Child

A child is about 1 meter tall
1 meter = 1,000,000,000 nm (1 billion nanometers)



Strand of Hair

A hair is about 0.1 (one tenth) of a millimeter wide
0.1 millimeter = 100,000 nm (100 thousand nanometers)



Microsize

Red Blood Cell

A red blood cell is about 10 micrometers wide
10 micrometers = 10,000 nm (10 thousand nanometers)



Bacteria

A bacteria cell is about 1 micrometer wide
1 micrometer = 1,000 nm (1 thousand nanometers)



Nanosize

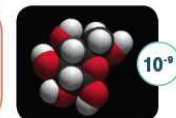
Cell Membrane

A cell membrane is about 10 nanometers wide
10 nanometers = 10 nm



Sugar Molecule

A sugar molecule is about 1 nanometer wide
1 nanometer = 1 nm



Macrosize
meters, decimeters, centimeters

Microsize
micrometers

Nanosize
nanometers

Synthesizing Nanoparticles

Solvothermal Method

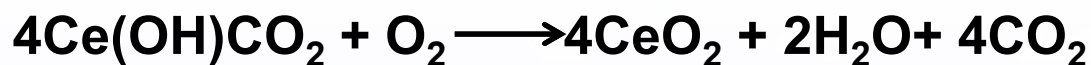
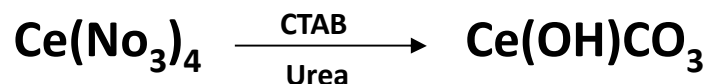


Cerium Oxide

■ Replicated paper:

Synthesis and Characterization of Single-Crystal $\text{Ce}(\text{OH})\text{CO}_3$ and CeO_2 Triangular Microplates

Zhiyan Guo, Fanglin Du,* Guicun Li, and Zuolin Cui



■ Anti-Corrosion

■ Solvothermal & Calcination

- 150°C for 10 hours
- 650°C for 1 hour



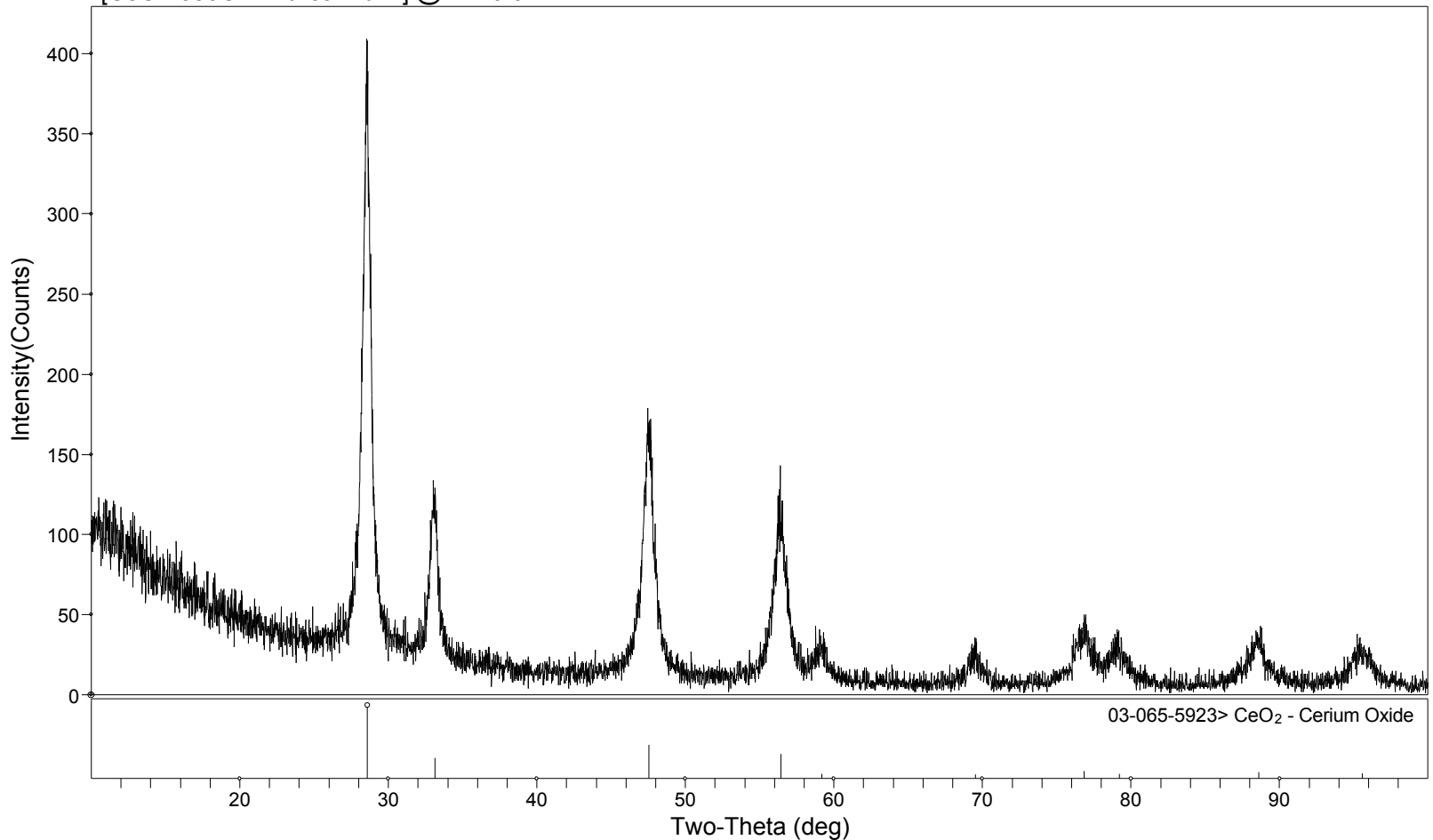
Laboratories



XRD(X-ray Diffraction)- Cerium Oxide

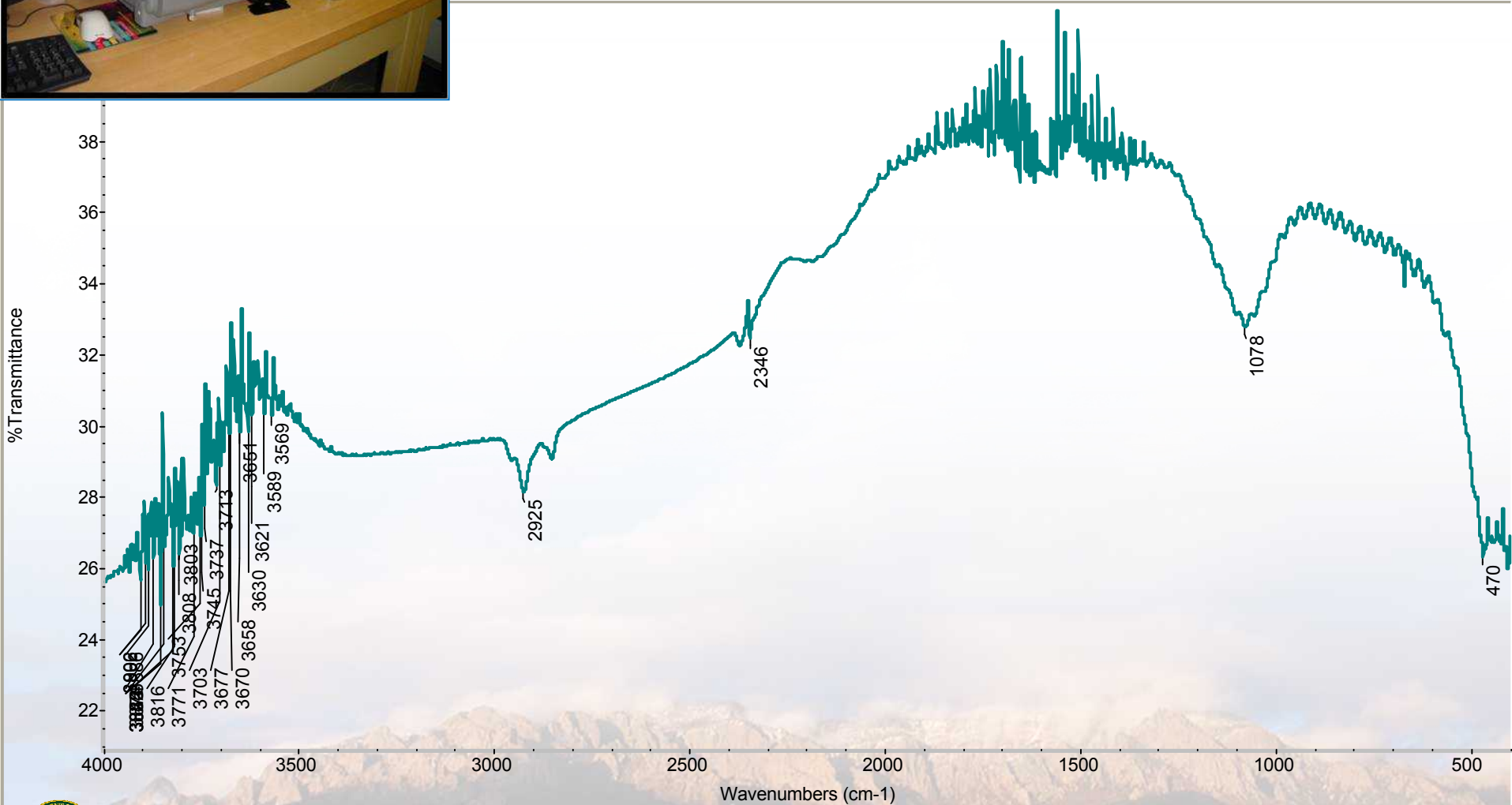


[CeO₂ 650C 1hr urea.xrdml] @Phi=0.0





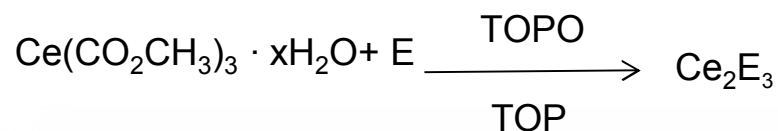
FTIR (Fourier Transform Infrared Spectroscopy)-Cerium Oxide



Cerium Chalcogenides

■ CeriumE

- E= Telluride, Selenide



■ Solvothermal

- 190°C 48hrs

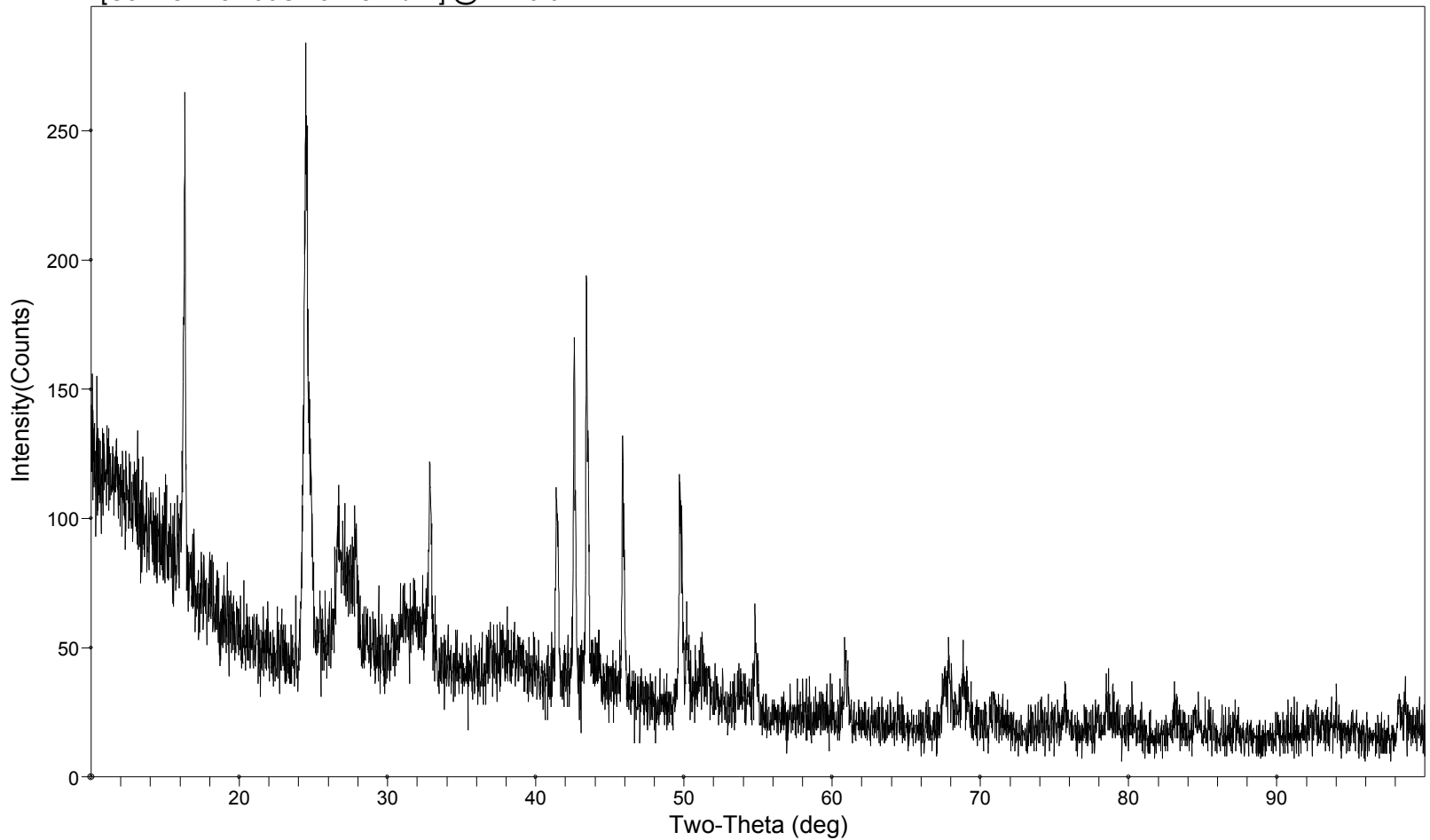
■ Washed in Methanol and Toluene



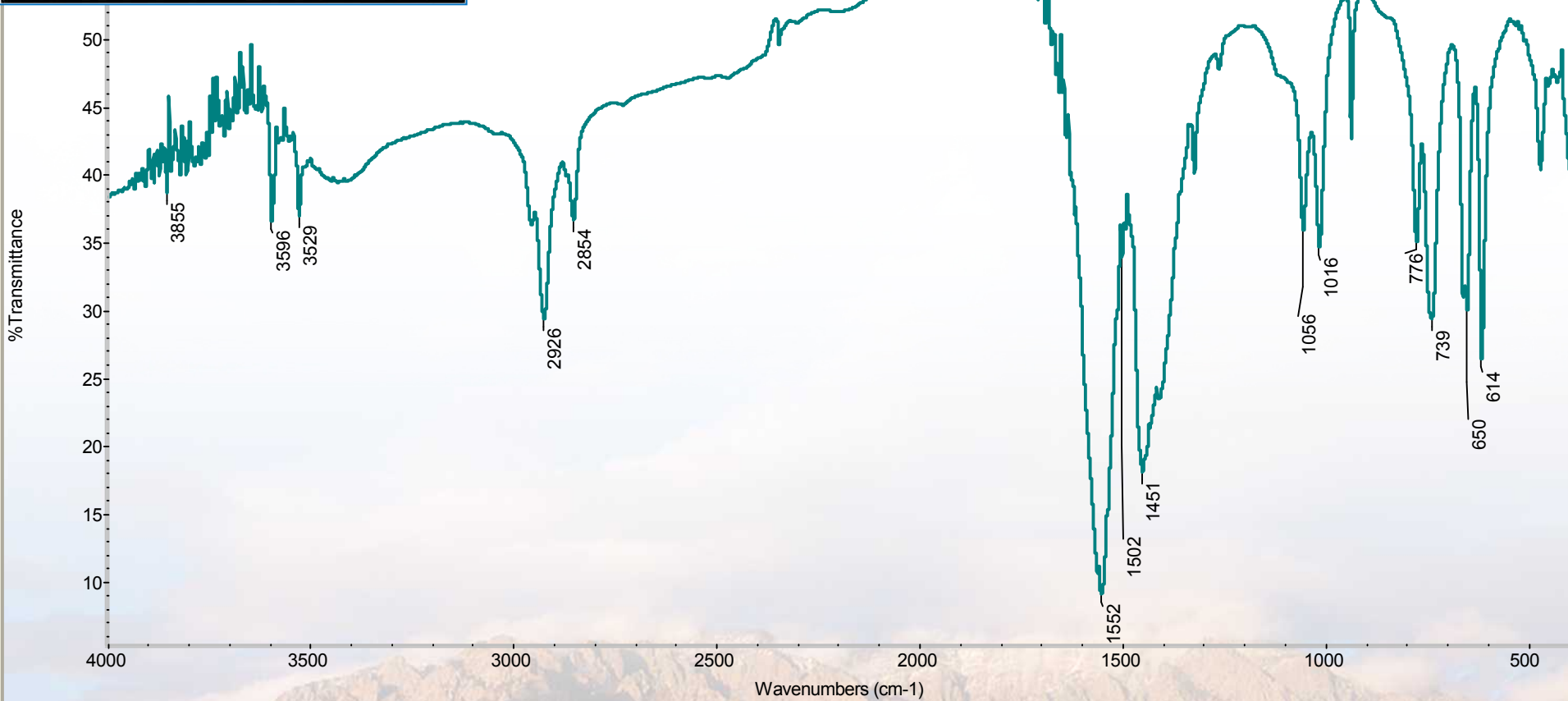
XRD- Cerium Telluride



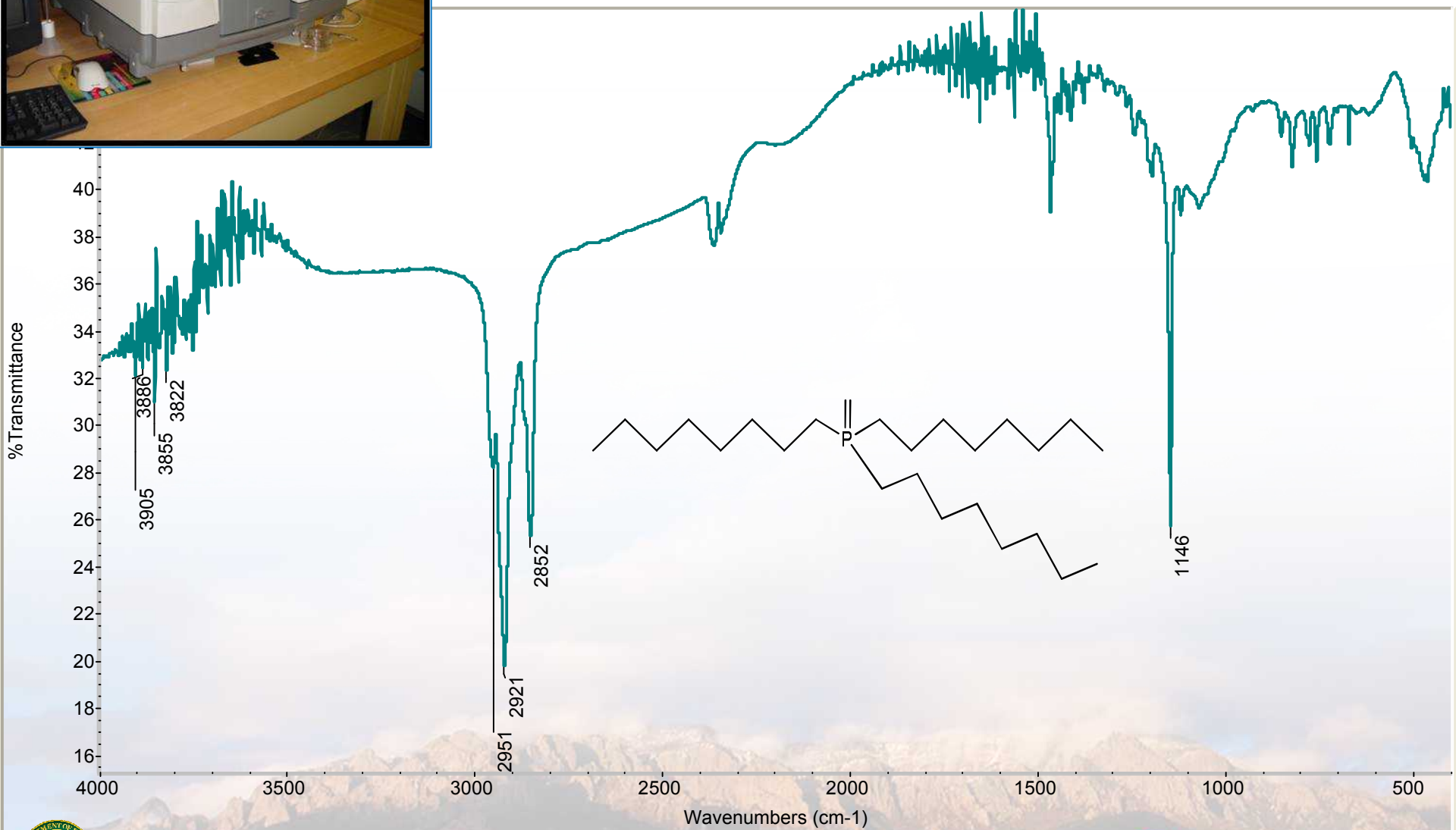
[Ce+TOPTe 190C 48 hrs.xrdml] @Phi=0.0



FTIR-Cerium Telluride

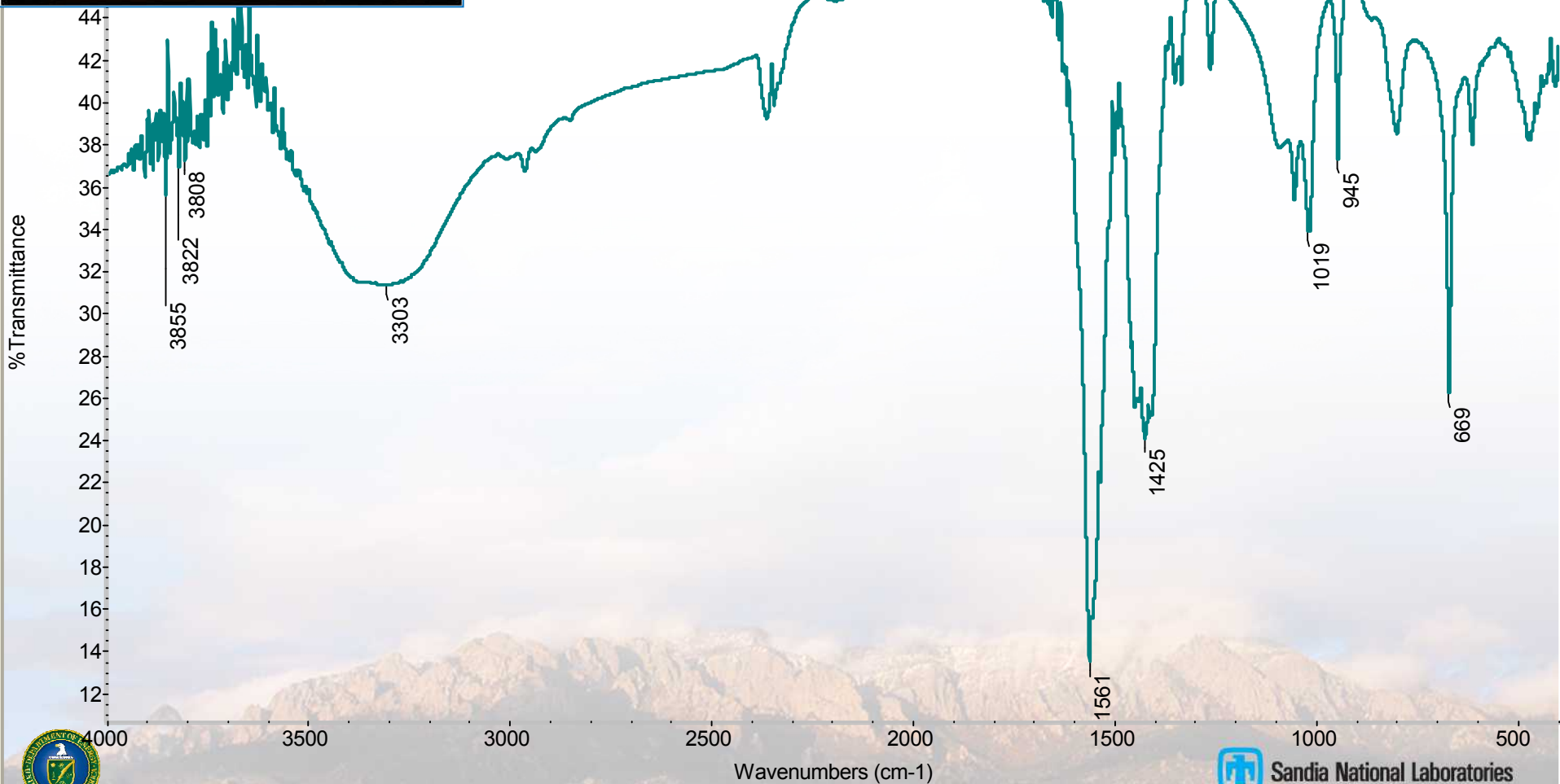


FTIR-TOPO



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FTIR- Cerium Acetate Hydrate



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iExplora! & CSI Dognapping

Outreach Program Goal: Extend public knowledge of science through interaction

■ i Explora!

- Facilitated activities on floor

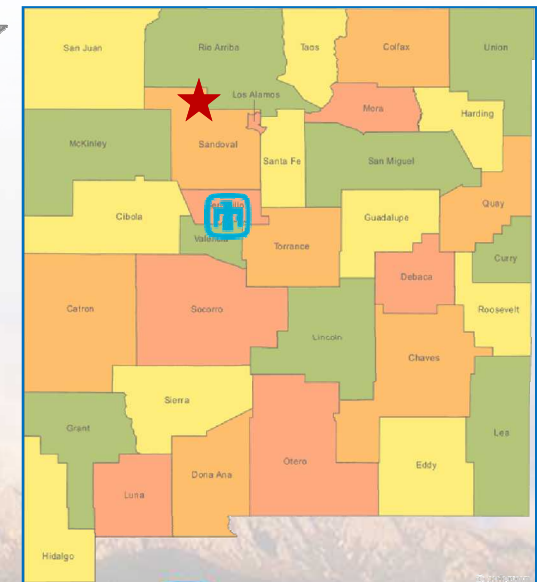
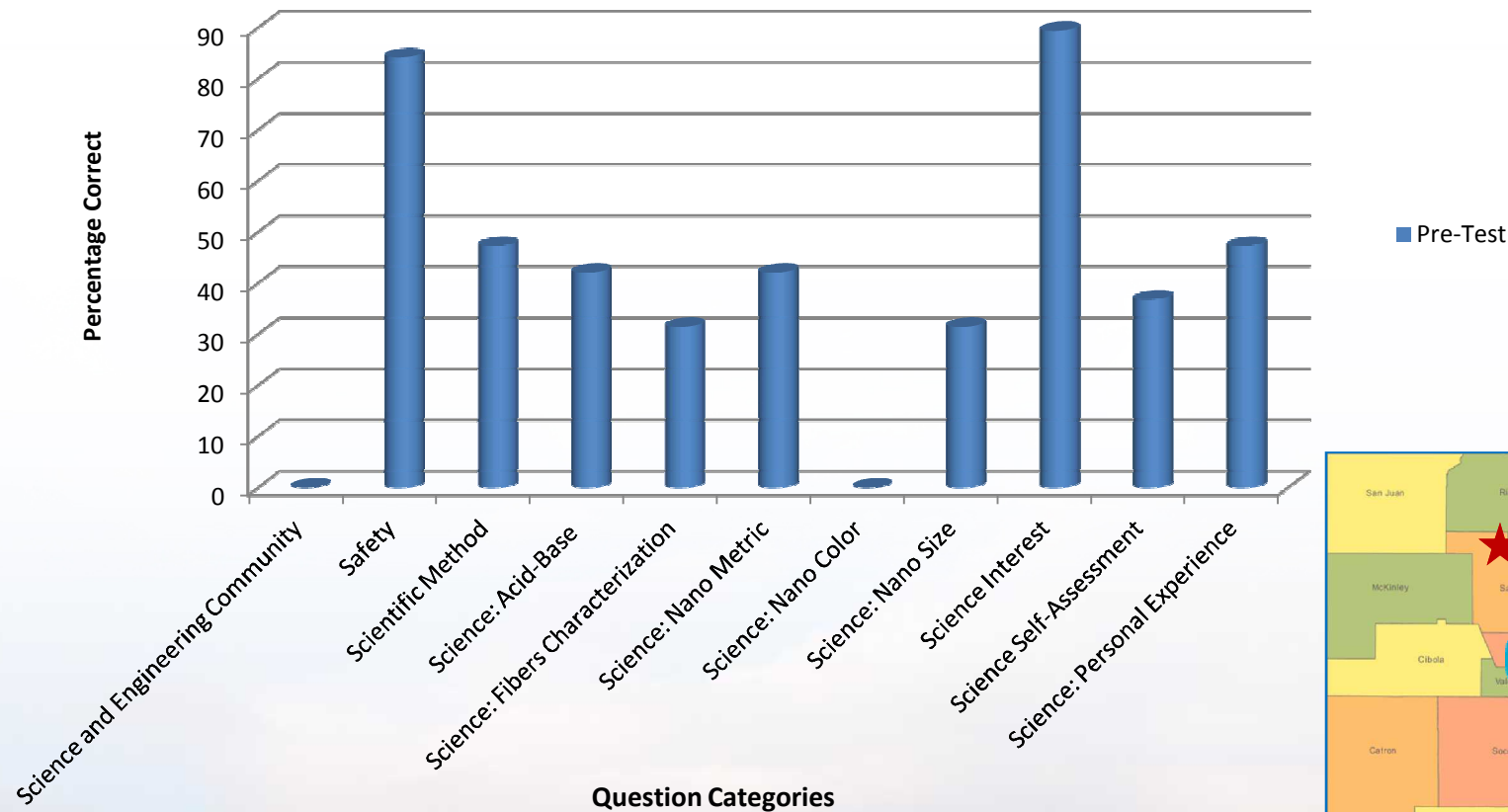
■ Dognapping

- Excite 4th graders interest in science & engineering
 - ◆ What I did for the program: Collect and Graph Data



Dognapping Data

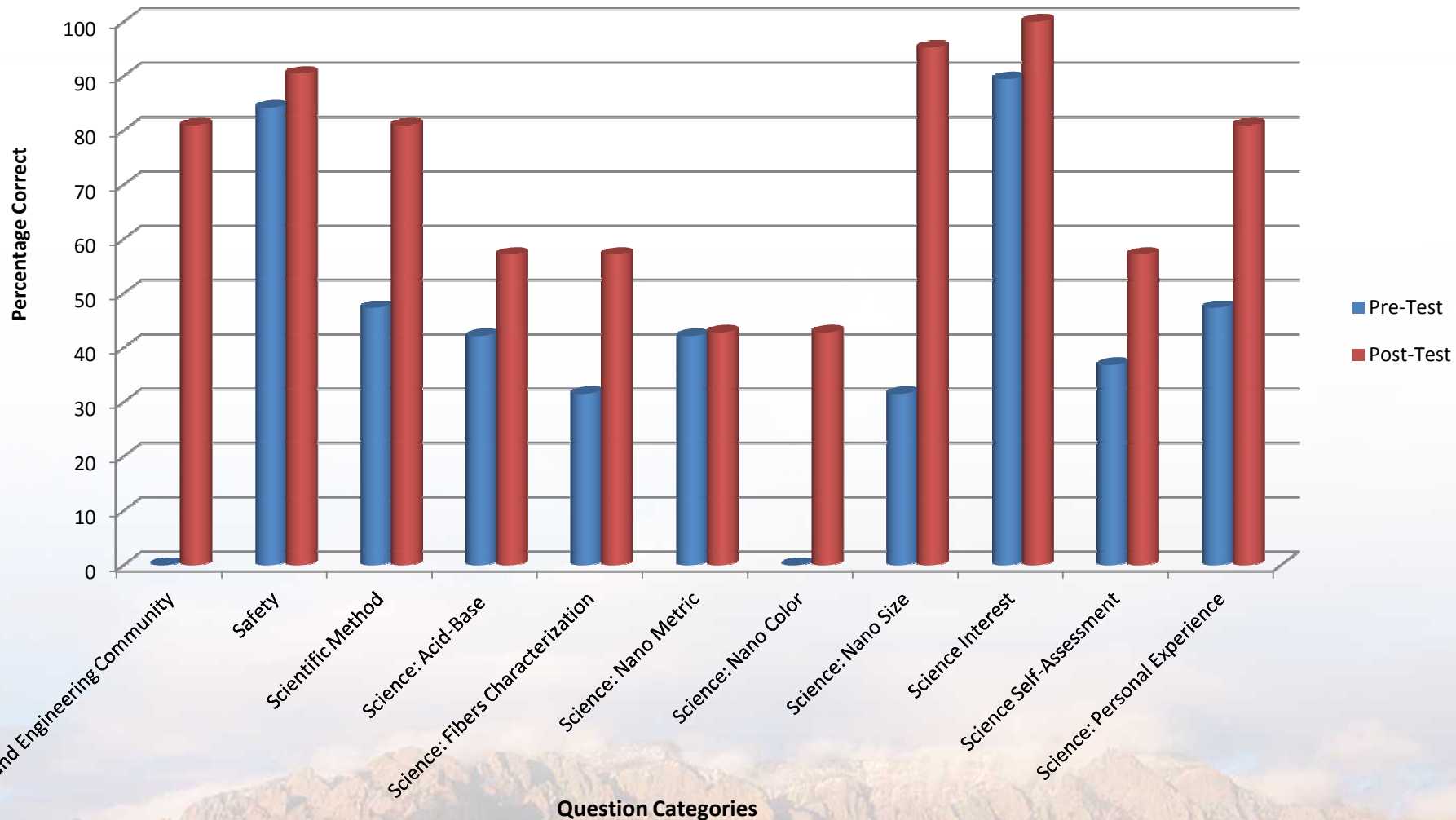
Lybrook



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Dognapping Data

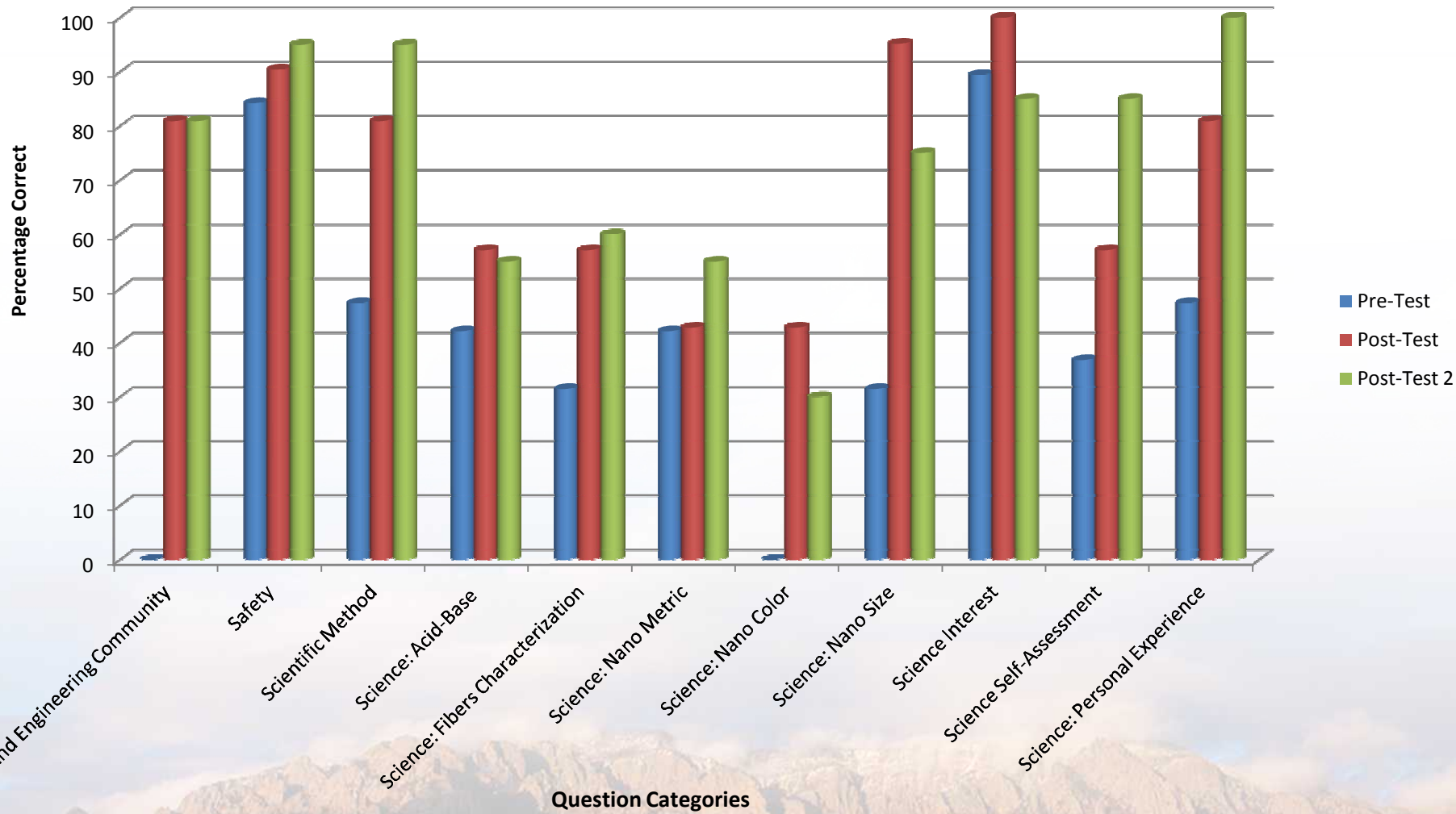
Lybrook



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Dognapping Data

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Summary

Knowledge Gained

■ Working in a laboratory

- Glovebox
- Fume Hood
- Analyzing FTIR results

■ Nanoparticles

- Properties and Applications
- Synthesizing
- Cerium

Future Work

- Stay for upcoming school year
- Cerium Reactions
- Lanthanide Chalcogenides



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