**GENERAL QUESTIONS**

1. Define the important terms associated with this paper: colloidal nanoparticle, polymorph, topotactic, metastable, chalcogenide, lattice, unit cell, octahedral, tetrahedral, ion exchange, solid state, preferred orientation, thermodynamic phase and kinetic phase, and template.

1. Make a list of the *eleven* acronyms in this paper and write out what each acronym is.
2. Read the abstract and first paragraph of this paper and then answer these questions. What was the goal of the research? What experiments did they do? Did they accomplish their goal?

1. What are the broad implications of this work? Why is it important that the authors can synthesize a metastable phase?
2. Give one example from the paper of how changing the structure (different polymorph) of a material changes the properties of the material.

1. Write a balanced chemical equation using Co2+ for the solid state ion exchange of stoichiometric roxbyite, Cu2-xS. Why are the ratios not 1 : 1 : 1 : 1?

**SOLID STATE STRUCTURE**

1. Describe the structure of the four phases in Figure 1 - rock salt, zincblende, wurtzite and NiAs - in terms of anion packing and cation coordination. How are these phases similar and how are they different?

1. Which of the four major structure types is roxbyite most similar to - rock salt, NiAs, wurtzite, and zinc blende?

**SYNTHESIS**

1. In your own words, describe what happens during the ion exchange process. What’s moving? What’s not moving?

**CHARACTERIZATION**

1. What conclusions do the authors draw from the EDS data in Figure *2*? Why do the EDS data support the authors’ claims?

1. Consult the EDS spectrum in Figure *S5* (go to the supplemental information <http://pubs.acs.org/doi/suppl/10.1021/jacs.5b10624/suppl_file/ja5b10624_si_001.pdf> ). What does this tell you about the completeness of the exchange? How does this data relate to Figure *2c*-*2g*. (You will need to look at an electronic copy of the paper to see the data in *2d* clearly, <http://pubs.acs.org/doi/abs/10.1021/jacs.5b10624> )
2. What conclusions do the authors draw from the powder XRD data in Figure 3? Why do the powder XRD data support the authors’ claims?

**ENERGETICS**

1. Identify the thermodynamically most stable phase in the CoS system and put the wurtzite and NiAs phases on a free energy diagram (only a qualitative diagram is required).

1. Why does using roxbyite as a template allow you to make the metastable wurtzite phase?

1. Describe why the authors say the NiAs phase does not form.