Special Topics: Structural Families of Functional Inorganic Materials

Catalog Description:

In this advanced inorganic materials course, we will learn how different crystal structural classes of materials are inter-related, and how properties evolve as a consequence of the different structural families.

Teaching frequency:

Every alternate Fall.

Target audience:

Graduate students who have taken Materials 218 or equivalent.

Textbooks:

Current literature

Instructor:

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Course Website:

`http://www.mrl.ucsb.edu/~seshadri/teach.html`

Outline (no guarantees):

1. Rock-salt, zinc blende, Half-Heusler and Heusler phases, and ferromagnetism.
2. Fluorite, pyrochlore, and structural materials.
3. Spinel, pyrochlore, and magnetic frustration.
4. Ice-I_h, the Bernal-Fowler rules, and zero-point entropy.
5. Spinel, garnet, magnetoplumbite, and ferrimagnetism.
6. The Verweij transition in Fe_3O_4 and $LiMn_2O_4$.
7. Chalcogenide spinels and the effects of covalency: ferromagnetic semiconductors.
8. Perovskite, Ruddlesden-Popper phases, and insulator-metal transitions.
9. Perovskite, Ruddlesden-Popper phases, and high T_C superconductivity.
10. Perovskite, Aurivillius phases, and ferroelectricity.
11. Perovskites, shear phases, TTB, HTB, and electrochromic materials.
12. Graphite intercalation compounds, staging.
13. PbO (litharge), vernier, chimney-ladder and misfit phases, and incommensuration.
14. Frank-Kasper and Laves phases, topological close packing, and quasicrystals.
15. High coordination, complex potential energy landscapes, and metallic glasses.
16. Chain and sheet silicates, Liebau's classification, zeolites, and sorption.