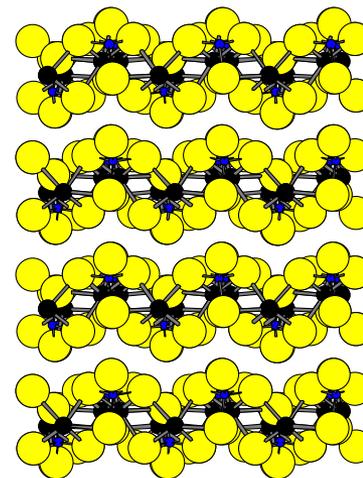


RUI: Metal Phosphorus Chalcogenides: Synthesis and Nonlinear Optical Properties

David A. Cleary, Gonzaga University (Chemistry), DMR-0102149

Technologically advanced materials begin with solid state chemistry. For example, materials which can convert infrared radiation to visible or ultraviolet radiation are synthesized with specific chemical and structural designs. This frequency conversion can result from the interaction of the infrared radiation with the bulk material or with impurities deliberately introduced into the material. This conversion finds applications in optical data storage, spectroscopy, and digital communication. We have prepared a variety of metal phosphorus chalcogenides with the goal of producing new materials which can be used for this conversion. One such candidate, LuPS_4 , is shown in the figure to the right. This new structure can be doped with lanthanide ions capable of frequency upconversion.



“Synthesis and Structure of a New Layered Phase in the Lanthanide Thiophosphates: LuPS_4 ,” D. A. Cleary and B. Twamley, *Inorg. Chim. Acta* **2003**, 353, 183.

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Education: Nine undergraduate students participated directly in this project or benefited from the resources provided by this project. Four undergraduate senior research theses were submitted, and eight presentations at scientific meetings were made by undergraduate students. One former student is now enrolled in the Ph. D. chemistry program at the University of Washington, and another former student is enrolled at Creighton University Dental School. The submitted theses included topics such as crystal growth, ^{31}P nuclear magnetic resonance, X-ray diffraction, and supercritical fluids.

Outreach: Three local high school chemistry teachers also worked on this project. One of the teachers used what he learned during the project to develop a crystal growing laboratory exercise for his class. Below is shown a crystal of lead iodide prepared by his students.

