



**Pacific Northwest**  
NATIONAL LABORATORY

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Pacific Northwest National Laboratory's expertise in material nuclear forensics is derived from the legacy of the nearby Hanford Site, where two-thirds of the United States plutonium stockpile was produced. Today, scientists and engineers at PNNL are involved in cutting-edge signature science related to the nuclear fuel cycle. Recent striking examples of this research are illustrated in these microscope images. These images depict thorium nitrate and uranyl sulfate crystals. These were obtained with a Nikon 400POL polarized light microscope (PLM) under cross-polars and (for the thorium nitrate images) with a  $\frac{1}{4}$  wavelength retardation plate. The PLM provides unique insight into materials and enables rapid screening of unknowns. The cross-polars image of the uranyl sulfate shows large 0.5 mm crystals exhibiting a wealth of interference colors. Contrast in the images are due to thickness variations across the crystal, much like the interference colors from an oil slick on water. During the crystallization of thorium nitrate in methanol the solidified regions have grown radially. These were observed with crossed polarized illumination as white regions with the black extinction crosses. When these thorium nitrate spherulites impinge, their boundaries become polygonal. The banding in these spherulites is indicative of a slow precipitation/ crystallization process.

*Director's Distinguished Lecture Series*

# Dr. Darleane Hoffman

August 4th, 2010 | Pacific Northwest National Laboratory

## Atom-At-A-Time Chemistry of the Transactinides

The transactinide elements provide a unique opportunity for exploring the uppermost end of the periodic table and comparing observed chemical properties with those of lighter homologues and theoretical predictions of chemical properties. The use of computer-controlled automated systems and physical "pre-separation" techniques to facilitate more detailed and comprehensive studies of chemical properties will be discussed. The prospects for extending chemical investigations to still heavier elements will be considered.