Temperature- and Time-Resolved X-Ray Powder Diffraction

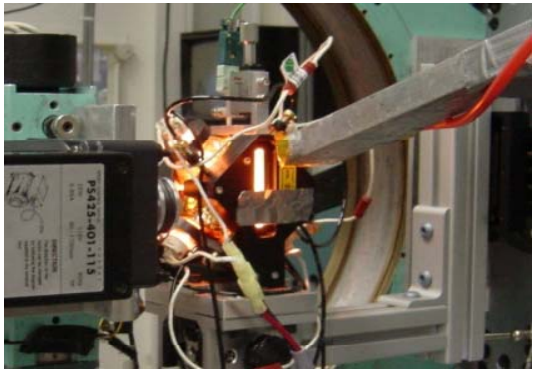
X14A, EERE-sponsored PRT beamline

Objective: Synchrotron x-ray investigations to advance materials for energy applications

Technique: Temperature- and time-resolved x-ray diffraction studies of phase transition and crystallization kinetics of materials, in ambience or with gas flow

Capabilities:

- High photon flux: typically $9x10^{11}$ photon/sec at 17 keV and $2x10^{12}$ photon/sec at 9 keV focused beam
- Quadruple lamp furnace* can heat capillary powder samples up to 2000°C
- Capillary heater with gas flow can monitor chemical reactions at up to 1100 °C. Plate sample heater up to 850 °C in vacuum or with gas flow.
- 640 channel Si strip detector * takes full diffraction pattern in minutes with 0.005 ° angular resolution

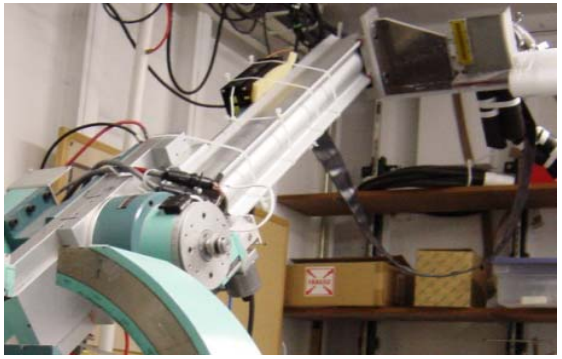


Quadruple lamp furnace

Plate sample heater

Ongoing Energy-Related Projects:

- In-situ XRD studies on the evolution of stresses and oxide layer growth in metallic interconnects for solid oxide fuel cell (SOFC) at high temperature (ORNL)
- High temperature structural characterization of modified fluorite-type electrolytes for SOFC (NSLS/ORNL/NJIT)
- In -situ synchrotron x-ray diffraction studies of the charge-discharge process of lithium transition metal phosphates for safer battery materials (BNL-Chemistry/ORNL)
- XRD investigation of the crystal and defect chemistry in nano-scaled derivatives of the olivine family Li*M*PO_4 , as cathode materials for high-performance lithium rechargeable batteries (MIT/ORNL)
- in situ high-temperature synchrotron diffraction studies of yttria-stabilized zirconia, an important thermal barrier coating material (GE/NSLS)
- Screening nanoceramics for sensing application using high-throughput and high-temperature powder diffraction (GE/NSLS)



The Si strip detector mounted on the X14A diffractometer

* Provided by NSLS