A compact, low power, infrared tube furnace for *in situ* and *in operando* X-ray powder diffraction

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We describe the implementation of a robust, easy to use, synchrotron-based x-ray powder diffraction apparatus for in-situ and in-operando material characterization at elevated temperatures and under controllable gaseous environments at BL 12.2.2 of the Advanced Light Source, Lawrence Berkeley National Lab. Synchrotron based powder diffraction yields easy to interpret information on crystalline materials (e.g. phase identification, crystallite size, lattice strain, among others) on 1-10's of second time scales. The ability to follow the evolution of materials at technologically relevant temperatures, under controlled atmospheres, at kinetically relevant time scales enables access to detailed insight of material synthesis processes, catalytic behavior, and other physio-chemical behavior. Our device operates from RT to 1100degC with temperature accuracy of better than 2% on pure samples (no diffraction temperature standards need to be added). The device temperature can be changed at ramping rates in excess of 300deg C/min. Gaseous environments from mTorr to ~2atm can be achieved with virtually any available gas (we have experience with oxidizers, reducers, hydrocarbons, and vapor mixes). Sample changes take a few minutes to execute. A number of scientific publications which employed the system will also be highlighted in this presentation.

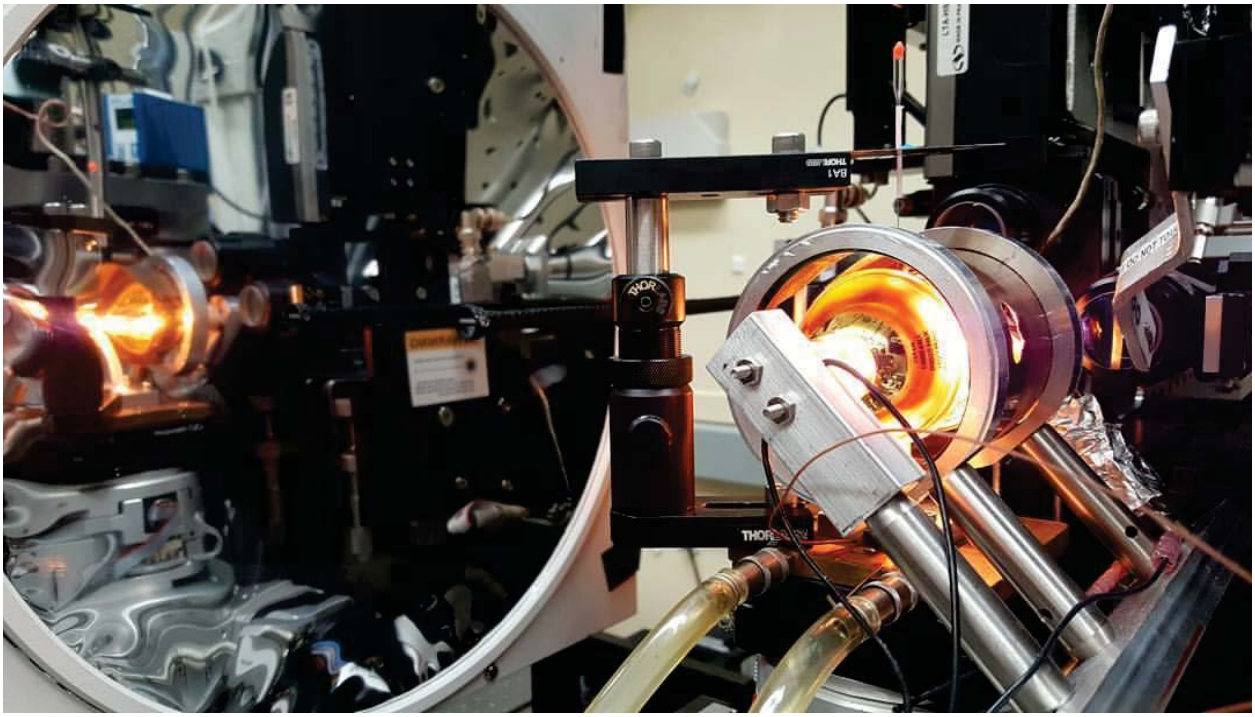

Figure 1- The lamp furnace in use on Beamline 12.2.2 at the Advanced Light Source.