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Solid State Laboratory
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Job Hazard Analysis
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Job Title **ROUTINE SOLID STATE CHEMISTRY LAB OPERATIONS (306 QDH)**
Date **October 10, 2004**
Task Evaluated_____ JHA#_____
Prepared By: **Prof. Svilen Bobev** Reviewed by_____

Approved by ____Supervisor ____Chairperson/Director
____Safety Chair ____Occupational Health & Safety

Job Description	Hazard Identification	Required Precautions
Routine materials handling including weighing of materials, mortar and pestle processing of powders, and storage of crystalline and amorphous solids, specimen, separation and transfer	Inhalation, ingestion, or absorption of chemical	This is a materials preparation/crystal growth operation. Many types of chemicals are used throughout this operation. Consult the appropriate MSDS before working with any unfamiliar materials. MSDSs are located on-line at www.udel.edu/OHS/msds/msds.html Reduced quantity is a substantial mitigation of risk. Only use the smallest amount of material practical. Substitute less-hazardous chemicals and forms when possible No eating or drinking is permitted in this laboratory, and to the extent practicable, the doors to the laboratory should remain closed at all times
Material incompatibility	Creation of unanticipated reactions, especially at elevated temperatures, producing explosion or loss of material containment	Existence of adequate incompatibility data shall be verified prior to beginning synthesis process. For more information check out the Hazardous material safety manual in the lab safety cabinet or online at: www.udel.edu/OHS/hazmatman97.html Additionally, all laboratory-produced samples must have a unique identification number and corresponding notebook description
Use of solvents for cleaning of chemicals and equipment	Inhalation, ingestion, or absorption of solvent, skin exposure, chemical splash	Solvents should be used only in the smallest practical quantity. In most cases, solvent-soaked material and excess solvent is controlled as a hazardous waste and must be disposed of properly. Gloves, safety eyewear, splash shield, lab coat, closed toe shoes must be worn

Acid/base/caustics operations	Skin exposure, splash, chemical burn from acids and bases	Because these operations are performed in solutions, particular care should be taken to avoid spills. Allow chemicals to return to room temperature prior to post-growth handling. Appropriate (i.e., nitrile not latex) gloves as well as eye protection shall be worn when handling chemicals in the liquid state. When working with corrosive chemicals a face shield and safety glasses with side shields or goggles is required as is a lab coat. Proper waste management training and waste disposal is a MUST
Operation of ultrasonic bath, hot-plate stirrer apparatus	Skin exposure, splash, thermal burns due to inadvertent contact with hot liquids or with surface of reaction vessel	Because the operating temperatures are relatively low (< 200-300ºC), the principal hazard mitigation is awareness. The temperature of the reaction vessel can be read from the temperature controller. Do not access the apparatus without being aware of the temperature
Operations of inert atmosphere glove box - use of compressed gas cylinders in generation of controlled atmosphere for sample processing	Release of stored energy due to cylinder or regulator failure or inadequacy of gas plumbing Asphyxiation due to release of large volume of gas	Only low-pressure gas flows are employed in this operation. Compressed gas cylinders must be secured at all times; appropriate regulators shall be used and plumbing shall be inspected prior to use. Cylinders are capped without regulators when not in use
Introduction and removal of material from furnace	Thermal burns while introducing, removing, and manipulating samples in hot furnaces	All furnaces are commercially available and unmodified. These furnaces are well-shielded and their external surfaces are cool to the touch even when the furnace interior is at maximum temperature; furnace doors must be kept closed when in use to ensure the integrity of this shielding. No maintenance work shall be performed on furnaces while hot. Kevlar safety gloves and face shield, as well as lab coat, closed-toe shoes are a must
Inadvertent contact with hot material	Thermal burns due to contact with material that has been removed from a furnace while at elevated temperature	The most likely source of thermal burns is contact with material (including samples, crucibles, and tongs) that have been removed from furnaces to cool. Use commons sense - any item that is sitting on a firebrick close to a furnace should be assumed to be hot and should not be touched without appropriate caution

Centrifugation	Thermal burn while sample is being transferred from furnace to centrifuge and during centrifuge operations	The centrifuge shall only be operated when its lid is closed. The same thermal PPE requirements exist as for furnace operation. Operator experience is also a significant mitigator of this hazard; do not attempt this procedure without having received appropriate on the . Centrifuge operations with samples at temperatures greater than 900°C requires a second observer be present
Utilization of breakable equipment and sharps – glassware, scalpel and razor blades, needles	Possible skin puncture	Gloves, closed-toe shoes, safety eyewear, tongs to pick up broken glass
Use of compressed gasses – argon, oxygen and hydrogen and associated plumbing	Release of stored energy due to cylinder or regulator failure or inadequacy of gas plumbing Asphyxiation due to release of large volume of gas Creation of unintended flammable/explosive mixture of hydrogen and oxygen	Only low-pressure gas flows are employed in this operation. Compressed gas cylinders must be secured at all times; appropriate regulators shall be used and plumbing shall be inspected prior to use. Adequacy of building ventilation shall be verified before compressed gas operations are initiated. Hydrogen cylinder is kept 20 feet apart from other gas cylinders. Special grade tubing for hydrogen and oxygen lines, equipped with flashback arrestors.
Use of laboratory press to compact ceramic or powder samples	Release of stored energy due to press or fixture failure	Because of the low compressibility of the powder samples, the stored energy during such operations is quite low. Maximum force limits of press shall not be exceeded. Alignments of press forms shall be verified visually prior to use
Use of hydrofluoric acid (HF) for materials cleaning	Severe chemical burns, inhalation, ingestion, or absorption of solvent	Details on the procedure, operations, exposure control, PPE are found in a separate document. No work without proper training and signing the user responsibility form
Use of X-ray diffraction equipment for structural studies. Occasional handling of single crystals containing radioactive materials – depleted U, Th in milligram quantities	Exposure to ionizing X-ray radiation, inhalation, ingestion, or absorption of radioactive materials	Details on the procedure, operations, exposure control, PPE are found in a separate document. X-ray equipment located in separate room - 304 QDH (X-ray laboratory). No work without proper training and X-ray badge.