Standard operating procedure for hazardous chemicals

Handling of nanomaterials

Note: this material applies to powders as well.

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- Lab Personnel who have reviewed SOP/Date: Raluca Gearba 9/16/2019

This SOP summarizes current National Institute of Occupational Safety and Health (NIOSH) recommendations regarding potential exposures to nanoparticles in a laboratory setting (materials are handled on a small scale). Additional information is available on the NIOSH website under the term "Nanotechnology" in the A-Z Index. NIOSH recommends conducting a risk assessment prior to working with nanoparticles. The risk assessment should consider potential routes of exposure, physical hazards and toxicological data or reasonable assumptions for the specific nanoparticles in use, and task hazards. Risk of exposure should be reduced to the maximum extent practicable through use of engineering controls, administrative controls, and Personal Protective Equipment (PPE).
The California Nanosafety Consortium of Higher Education has published a "Nanotoolkit" for "Working Safely with Engineered Nanomaterials in Academic Research Settings." This publication provides an easy to use tool kit for academic researchers to quickly identify safe handling practices based on whether the work they propose is in a low, moderate, or high potential exposure category. All persons conducting research with engineered nanomaterial are strongly encouraged to review and implement the tool kit.
https://www.ehs.uci.edu/programs/sop_library/Nanotoolkit.pdf

Laboratory-specific written procedures are required for work with nanomaterials, including a designated work area. This SOP is a combined SOP for all nanomaterials, as long as the materials do not pose other significant hazards (such as flammables, pyrophorics, explosives, water reactives, etc). For nanomaterials with other significant hazards, material-specific SOPs are required. Researchers must discuss with TMI staff before using such materials.

Risk Assessment

Hazardous Chemicals: *(List chemicals used. Include chemical name, common name and abbreviation)*

Nanoparticles – particles 1-100 nm in size.
Powders without a known size distribution.

Potential Hazard(s): *(Describe the potential hazards associated with the chemicals or the procedure.)*
Nanoparticles are very small, ranging in size from 1-100 nm. Their very small size imparts unique physical and chemical properties that differ from the parent compound. Research regarding potential health effects of exposure to various nanoparticles is lagging behind growth of nanotechnology. However, several studies present strong evidence that:

- Biological effects of exposure to nanoparticles may be related to particle size, shape, solubility, ability of the particle to bind to biological proteins and receptors, and other factors.

- Nanoparticles have greater physical reactivity than the parent compound, often acting as a catalyst in chemical reactions, and presenting greater fire and explosion risks.

Routes of Exposure: *(As applicable, describe the potential routes of exposure associated with the procedure such as inhalation, injection, skin/eye contact)*
Ingested: Nanoparticles can be ingested via unintentional hand to mouth transfer or larger particles that deposit in the mouth, nose, or throat which can be swallowed.
Inhalation: Inhalation is the route of exposure of greatest concern. Animal studies suggest that inhaled nanoparticles can enter the bloodstream and translocate to other organs. At present, there are no specific occupational exposure limits for nanoparticles. Possible routes of exposure:

- Handling (e.g., weighing, blending, spraying) powders of nanomaterials.
- Maintenance and cleaning of equipment and processes used to measure or fabricate nanomaterials.
- Cleaning-up of spills or handling waste containing nanomaterials.
- Cleaning of dust collection systems used to capture nanoparticles.
- Machining, sanding, drilling, or other mechanical disruption of materials containing nanoparticles.

Skin contact: Nanoparticles may be capable of penetrating healthy intact skin and translocating to other organ systems following penetration.

Quantity/Concentration Hazards: *(As applicable, describe if the quantity/concentration of the chemical increases the risk associated with exposure to the chemical.)*
At present, there are no specific occupational exposure limits for nanoparticles. Be aware that toxicity of nanomaterials may be greater than for the parent material, and that their greater surface area may make nanomaterials more flammable, explosive, or reactive than larger particles of the same composition. The risks of fire/explosion/reaction increase with the amount of nanomaterial.

Substitution of Less Hazardous Chemicals: *(As applicable, describe the potential use of less hazardous chemical substitutes)*
The first considerations in managing the risk associated with nanoparticles are hazard elimination, followed by substitution with a less hazardous product. In many cases, this will not be possible due to the nature of the work. When the hazard cannot be eliminated then the risk is managed through implementation of feasible engineering and administrative controls, as well as appropriate PPE.

Control Measures

Personal Protective Equipment (PPE): *(List all applicable personal protective equipment needed for procedure)*
Currently there are no generally acceptable guidelines available based on scientific data for the selection of protective clothing or other apparel to protect against exposure to nanomaterials. The following PPE recommendations are consistent with conventional handling of chemicals.

- Lab coats with sleeves fully extended to the wrist must be worn at all times. Impermeable coats with ribbed cuffs are the best choice. Lab coats may not be taken to private homes and laundered, and they should not be worn or stored in “clean” areas outside of the lab. Alternatively, disposable lab coats can be used and then discarded when leaving the lab.
- Wear long pants and closed toe shoes.
- Arm sleeves should be used where high levels of exposure or splashes of solutions containing nanoparticles are anticipated.

- Eye protection appropriate to the tasks performed is required. This may include safety glasses, face shields, and/or chemical splash goggles. Face shields and safety glasses do not provide sufficient protection against unbound, dry materials that could become airborne.
- Gloves should be worn when handling nanomaterials. Broken skin presents greater potential for exposure. Choose gloves only after considering the resistance of the glove to both the nanomaterial and any associated chemical. Two pairs of gloves should be worn so the outer pair which can get contaiminated with nanoparticles can be disposed of in a bag in the fume hood. Situate the cuff of the glove over the ribbed cuff of the lab coat or other outer protective garment.
- If airborne contaminants cannot be effectively controlled through local ventilation, a full-face respirator may be needed. Contact EHS prior to using a respirator.

Observe good chemical hygiene practices. Wash hands and exposed skin after removing PPE and before leaving the laboratory. Change disposable gloves frequently and when likely to be contaminated dispose of the gloves in a dedicated 2 mil plastic bag. The bag will subsequently be disposed off in a solid chemical waste container (plastic 30 Gal drum provided by EHS). The drum will have a waste tag attached to it.

Engineering Controls: *(As applicable, describe the engineering controls used for the procedure)*
The primary engineering control related to nanoparticle work is ventilation to prevent airborne exposures. Feasible ventilation controls must be used to minimize potential exposure to airborne nanoparticles. Other controls (administrative and PPE) are not a substitute for engineering controls.

- In general, labs that handle non-encapsulated nanomaterials must have negative pressurization to the hallway. Lab doors must be kept closed at all times.
- Activities that are likely to release nanomaterials (e.g., opening sample tubes, needle aspiration of liquids containing nanomaterials, weighing of dry nanomaterials, cleaning of instrument chambers, etc.) should be performed in a glove box, glove bag, fume hood, biosafety cabinet, or other exhausted enclosure. When enclosure in a ventilated device is not feasible, an articulating fume extractor positioned close to the work zone and with sufficient capture velocity may be an acceptable alternative.

Engineering controls are generally not required for nanomaterials that are encapsulated in a solid, nanocomposite, and surface coated material unless cutting or grinding is conducted.

Work Practice Controls: *(As applicable, describe work practice controls used for the procedure)*
Appropriate safe work practices must be observed when handling nanomaterials that present risk of exposure.

- Conduct a risk assessment before engaging in work with nanomaterials. Review literature to identify physical characteristics and health hazards prior to handling nanomaterials. Review the work processes to be conducted and equipment to be used to ensure that work can be conducted safely in the intended area of use, with the intended equipment, and appropriate engineering controls (e.g., ventilation, etc.) are available and in working order.
- Observe standard good chemical hygiene practices, including but not limited to the following:
  - ✓ Minimize potentially contaminated areas by confining operations to designated areas of the smallest feasible size.
  - ✓ Keep work areas clean and uncluttered. Dry sweeping or air hoses are prohibited for use when cleaning work areas potentially contaminated with nanomaterials. HEPA vacuums or wet-methods are acceptable, although wet methods are preferred. Clean work areas at the end of your process.

- ✓ If weighing dry powders and the balance cannot be located in a fume hood, tare a container then add the material to the container in a hood, then seal the container before returning to the balance to weigh the powder.
- ✓ Keep containers closed as much as possible. Once work with nanomaterials is complete, wipe the work area down with a soap and water solution.

- Promptly and thoroughly clean up spills, leaks, and drips. It is recommended to handle solutions containing nanoparticles over disposable bench liners that have an impervious backing or trays to facilitate clean-up.
  - ✓ Avoid underestimation of the risk. Most nanoparticles have not been thoroughly evaluated for toxic effects.
  - ✓ Do not leave potentially dangerous processes unattended.
  - ✓ Handle and store glassware with care. Do not use cracked or chipped glassware. Properly dispose of damaged or broken glassware in broken glass/sharps receptacles, not the trash container. Dispose contaminated needles and other sharps in an appropriate sharps container.
  - ✓ The laboratory must be equipped with hand washing facilities and an emergency eyewash. Always wash hands and other exposed skin areas after removing PPE, prior to exiting the laboratory area, and before eating or drinking.
  - ✓ Notify EHS of suspected exposures.

The preferred method for nanoparticle manipulation is in solution. Once in solution, it may be handled on the lab bench using the same precautions as is necessary for other chemical solutions. However, any agitation, sonication, or other aerosol producing technique must be conducted in a ventilated enclosure.

Monitoring: *(As applicable, describe any monitoring needed for the procedure)*
All handling of dry nanoparticles should be performed in a ventilated area.

Use in Animals: *(As applicable, describe how the chemical will be safely used in animals)*
Non Applicable

Cleanup Procedures: *(Describe the process for cleaning the work area during and after the procedure.)*
Strategies used to mitigate and cleanup a nanomaterial spill are similar to those employed for releases of chemicals and biological agents. Primary considerations include preventing exposures and minimizing the impacted area. As with any spill/release, evacuation of the area and notification of response authorities is appropriate if the situation is an imminent hazard.
Wet cleaning methods are preferred to HEPA vacuum methods. For solid/powder nanomaterials, dampen the surface of the spill with a compatible liquid (soap/water, cleaning oil, etc.). Take care to dampen gently to avoid the production of aerosols. Wet wipe the affected area with a disposable cloth/wipe. Repeat cleaning of the area several times using fresh cleaning solutions and wipes. Seal used wipes in a bag to prevent aerosolizing of the nanomaterials upon drying. Dispose of used wipers via EHS. Use the same strategy for liquid materials, except use a disposable wiper to first absorb the liquid.
Appropriate PPE must be worn when cleaning up a spill. Do not use energetic cleaning methods such as dry sweeping or compressed air.

Storage Procedures: *(Describe how and where the chemical will be safely stored)*
All nanomaterials should be stored in clearly labeled closed containers. See more details below.

Transportation Procedures: *(If the chemical will be transported on campus, describe procedure)*
- Nanomaterials must be in sealed shatter-resistant containers during transportation. If the container is not shatter-resistant, use a secondary container.

- Containers must be labeled with nanomaterial name (or composition) and approximate particle size, along with any known hazard warnings.
- If the material may be flammable, reactive, or explosive, keep away from heat and open flame.

Keep these powders away from any incompatible materials. *(List any specific incompatibles.)*

Waste Disposal Procedures: (*Description of how waste will be disposed)*
The following waste management guidance applies to potentially contaminated nanomaterial waste streams consisting of:

- Pure nanomaterials (e.g., carbon nanotubes).
- Items contaminated with nanomaterials (e.g., wipes, pipettes, culture plates, PPE, etc.)
- Liquid suspensions containing nanomaterials.
- Solid matrices with nanomaterials that are loosely attached to the surface such that they can reasonably be expected to break free or leach out when in contact with air or water, or when subjected to reasonably foreseeable mechanical forces.

Dispose of nanomaterial liquids, powders, and contaminated papers, wipes, disposable PPE, etc. via EHS. All nanoparticles waste should be collected in 2 mil plastic bags that are sealed (provided by TMI). This also applied to nanomaterials embedded in a solid matrix. All outer gloves should be sealed in the bag inside the glove box to reduce the risk of releasing nanomaterials outside of the fume hood. Do not handle nanomaterials without prior identification of an appropriate 2 mil bag. These 2 mil bags will be collected in a 30 mil drum with an appropriate waste tag attached.

Emergency Procedures: *(Describe what procedures should be followed in the event of an emergency)*

Spills or Releases: *(Provide specific instructions on what personnel should do in the event of a spill or gas release. Include location of spill kits.)*
Unless there are other hazards (such as reactivity) associated with the nanomaterials, the following recommendations should be adequate.

- For small spills of liquid suspensions, absorb the spilled material with a suitable absorbent (determined in advance), then wet-wipe the affected area three times. Place all absorbent and PPE into a bag and seal, place in the provided waste drum and submit paperwork for disposal to EHS.
- For spills of dry nanomaterials in a chemical fume hood or other enclosure, wipe up the powder using a cloth dampened with a suitable absorbent, (determined in advance) or wet the powder with a suitable absorbent and then wipe with a dry cloth. Consider using electrostatic microfiber cleaning cloths, especially if the nanomaterial is likely to carry an electrostatic charge. Minimize the fume hood or enclosure opening during this process. Once spill has been cleaned up, wet-wipe the affected area three times to decontaminate the surface.
- For spills of dry nanomaterials or major spills of liquid suspensions outside of a chemical fume hood or other enclosure, leave the area and request assistance by calling 911 from a campus phone or if during working hours, contact EHS at 512-417-3511. *Also contact the TMI staff and your supervisor.*

Fire: *(Provide specific instructions on what personnel should do in the event of a fire)*
In case of a small fire and if properly trained use the fire extinguisher located in the lab. Inform the TMI Staff and your supervisor.
In case of an extensive fire call 911 immediately.

Emergency Shut Offs: *(If applicable, describe procedures for shutting down equipment in an emergency)*

In case there is a need to leave the area where nanoparticles are being handled because of an emergency please leave the sign "Nanoparticles in use" sign on the hood in clear view.

Signs and Symptoms of Exposure: *(Describe the specific signs and symptoms of an exposure to the chemical)*
Most nanoparticles have unknown health effects. Contact UT's Occupational Health Program at 512-471-4647 for exposure-related advice.

Exposures: *(Provide specific instructions on what personnel should do in the event of an exposure)*
For minor injuries and exposures to hazardous materials during regular business hours call the HealthPoint Occupational Health Program: 512-471-4647.
In the event of a serious injury, or other life threatening situation, call 911. Remember to have your name, number, location, and any other pertinent information available at the time of the call. It is important to inform the safety office and the police if anyone has been injured or if there has been a personal exposure.

For an actual chemical exposure/injury:

- Flush exposed eyes or skin with water for at least 15 minutes, then seek medical attention if needed.
- For situations with risk of inhalation exposure (including dry powder spills outside of a chemical fume hood), remove all persons from the contaminated area and contact the EHS spill team.
- Call 911 from a campus phone to request assistance if needed. Contact UT's Occupational Health Program at 512-471-4647 for exposure-related advice.

The work-related injury or illness submit report found at:
https://hr.utexas.edu/sites/hr.utexas.edu/files/Incident_Injury_Memo.pdf (this documents should be completed within 24 hours).

Occupational Health Requirements: *(Describe any Occupational Health requirements necessary that are associated with the procedure. Examples include medical evaluation, baseline serum samples and respiratory fit testing)*
There is no specific evaluation required prior to handling nanomaterials.

Material Safety Data Sheets (MSDS): *(Describe how personnel will access MSDS in the lab. Include a copy of the MSDS with this SOP)*
Students have the obligation to provide the TMI Staff with the MSDS for all nanomaterials whenever possible. Those materials will be kept in the lab in a dedicated folder. Be advised that MSDSs for parent materials are not enough.

Training Requirements: (*Describe what training personnel must complete before using chemical/procedure. This training should be documented)*
- Required trainings: OH101, OH102, OH201, OH202, OH238, FF205.
- Training on lab-specific procedures is required for all personnel working with these materials, and must be documented (topics covered, date, employee names and signatures). Laboratory-specific training for work with nanomaterials must include information on the relatively greater hazards of working with nanomaterials, and on the uncertainty of health effects.

- All personnel shall read and fully adhere to the laboratory- and nanomaterial specific SOP, and shall document that they have read it by signing and dating the SOP.

Review of Procedure: *(Describe the frequency for reviewing the SOP document)*
The present SOP will be reviewed every 6 months.

Protocol:

Description of how to safely perform the experiment or operation.

General Protocol (must be followed by all lab users regardless of instrument used):

1. All users bringing nanomaterials into the TMI labs must ensure that these chemicals are stored in a sealed shatter-resistant container. **Containers must be labeled** with the nanomaterial name (or composition) and approximate particle size, along with any known hazard warnings. Clearly state the name of the user and the name of the PI.
2. Do not bring in the TMI labs nanomaterials that pose other significant hazards (such as flammables, pyrophorics, explosives, water reactives, etc).
3. Handling of all nanoparticles will be performed in the dedicated fume hood in EER, 6.626.
4. Wear a lab coat, safety glasses and two pairs of nitrile gloves.
5. Before handling nanoparticles, make sure that an appropriate 2 mil waste bag is available in the fume hood for disposal of any generated waste.
6. Make sure that all surfaces are dry and clean before handling any nanomaterials.
7. Locate the spill kit supplies and make sure that to have wet towels around in case of a small spill.
8. Be aware of the location of the eyewash and shower.
9. Post the "Nanoparticles in use" and "NO OTHER PROCESSES ALLOWED AT THIS TIME" signs on the hood in clear view.
10. NEVER LEAVE THE HOOD UNATTENDED WHILE NANOMATERIALS ARE IN USE. YOU CAN LEAVE THE HOOD ONLY AFTER THE WASTE HAS BEED DISCARDED AND THE HOOD IS CLEAN.
11. Dispose of all nanoparticles and waste contaminated with nanoparticles (e.g., wipes, pipettes, gloves, carbon tape, etc..) **promptly** in an appropriate 2 mil waste bag that is compatible with waste generated. Do not leave waste sitting in the fume hood while you work on equipment.
12. Clean tweezers, beakers, sample holders with acetone and then ethanol in the fume hood. The waste solvent should be collected in the provided waste container under the hood.
13. Remove the outer pair of gloves and put in the waste bag.
14. **DO NOT WEAR GLOVES CONTAMINATED WITH NANOPARTICLES OUTSIDE OF THE FUME HOOD.**
15. Seal the bag in the fume hood and place it in the blue waste container. This container will have a specific waste tag for nanoparticles attached to it.
16. Follow specific protocol for each instrument outlines below.

Handling nanoparticles for the usage with the Quanta 650, Hitachi 5500 and the Scios 2 HiVac SEMs

1. Take a SEM holder (stub or disk) and bring it to the fume hood in EER 6.626.
2. Attach carbon tape to the holder.
3. Deposit few mgs of materials onto the carbon tape. Firmly press the material down using a flat section of a spatula or a tweezer while covering the powder with the clean white support of the carbon tape. Tap sample holder on a solid surface to ensure material is sturdily fixed to the adhesive.

4. Transport the sample holder to the instrument in a plastic box.
5. After measurements, bring the SEM stub to the fume hood and dispose of the waste into an appropriate waste bag. Clean the SEM stub with acetone, methanol and return it to the instrument.
6. Report any problems encountered to Raluca Gearba at gearba@austin.utexas.edu or Andrei Dolocan at adolocan@austin.utexas.edu.
7. Non-trained personnel can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the Horiba fluorimeter or the Cary UV-VIS Spectrometer

1. Attach the carbon tape or scotch tape to the dedicated sample holder.
2. Deposit the material on the adhesive tape in the fume hood.
3. Press the material down using a tweezer or the flat side of a spatula. Make sure that the nanomaterial is sturdily fixed to the adhesive.
4. After measurements, bring the holder to the fume hood and dispose of the waste into an appropriate waste bag. Clean the sample holder with acetone, methanol and return it to the instrument.
5. Report any problems encountered to Raluca Gearba at gearba@austin.utexas.edu.
6. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the TOF-SIMS

1. Adhere double sided carbon tape to a silicon or thin-polished metal substrate.
2. Deposit a small amount (few mg) of material on the carbon tape while working in the fume hood.
3. Firmly press the material down using a flat section of a spatula or a tweezer while covering the powder with some clean white support of the carbon tape. Tap sample on a solid surface to ensure material is sturdily fixed to the adhesive. Collect and dispose any excess powder that comes off from the carbon tape. Attach the sample to the TOF-SIMS sample holder using carbon tape.
4. After measurements, take the sample holder to the fume hood and dispose of the waste into an appropriate waste container. Wipe clean the sample holder with isopropanol and return it to the instrument.
5. Report any issues and/or problems to Andrei Dolocan at adolocan@austin.utexas.edu.
6. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the X-ray diffraction facilities

Method I (preferred)

For powders that are stable in methanol or other solvent, prepare a “slurry” of the material in the solvent, spread onto the smooth side of an x-ray powder diffraction sample holder or glass slide and allow the solvent to evaporate in the fume hood. Such samples are generally stable and can be transported directly to the instrument.

Method II (good)

Using smooth side of x-ray powder diffraction holder, place a very light coating of vacuum grease on surface of holder. Cover the coated area with powder sample. The sample can be left on the coated area for a few minutes to “soak in” or can be lightly compacted into the grease with a glass microscope slide. Incline holder and tap excess material onto weighing paper or tissue for disposal. These samples can be directly transported to instrument.

Method III (most often used)

Fill depression in glass x-ray powder diffraction sample holder with material, using a small excess. Smooth the material with a glass slide or spatula until it just fills the depression and is even with the top of the holder surface. Place holder in appropriate transport container and carry to instrument.

All Methods

- After measurements are completed, carefully remove sample holders from instrument and transport back to fume hood. Recover any material possible and remove from lab back to your workplace.
- Waste materials can be placed in appropriate disposal bags provided by TMI.
- Clean holders, glass slides with methanol and return to provided containers.
- Contact Steve Swinnea (swinnea@che.utexas.edu) for samples that pose special problems.

Handling nanoparticles for the usage with the XPS

7. Adhere carbon tape to the Kratos XPS sample holder.
8. Deposit 1 to 5 mg of material on the carbon tape while working in the fume hood.
9. Firmly press the material down using a flat section of a specula while covering the power with clean aluminum foil. Tap sample bar on a solid surface to ensure material is sturdily fixed to the adhesive. Collect and dispose any excess powder that comes off from the carbon tape.
10. After measurements, take the sample holder to the fume hood and dispose of the waste into an appropriate waste container. Wipe clean the sample holder with acetone, methanol and return it to the instrument.
11. Report any issues and/or problems to Hugo Celio at hugo.celio@utexas.edu.
12. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the TGA

1. Deposit 1-5 mg of the material into an aluminum crucible while working in the fume hood.
2. After measurements, take the aluminum crucible to the fume hood and dispose of the waste into an appropriate waste container. Return all used crucibles into the grey metal box located next to the TGA.
3. Report any issues and/or problems to Hugo Celio at hugo.celio@utexas.edu.
4. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the FTIR

1. Deposit 1-5 mg of the material on the carbon tape/aluminum holder while working at the fume hood.
2. Press the material down using a flat section of a specula while covering the power with clean aluminum foil. Tap sample holder on a solid surface to ensure material is sturdily fixed to the adhesive. Collect and disposed any excess powder that detaches from the carbon tape.
3. After measurements, take the sample holder to the fume hood and dispose of the waste into an appropriate waste container. Wipe clean the sample holder with acetone, methanol and return it to the instrument.
4. Report any issues and/or problems to Hugo Celio at hugo.celio@utexas.edu.
5. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the DLS

1. Place 1 ml of the solution into polystyrene (or glass) cuvette while working with absorbing matt, located next to the blue trey of solvents.
2. After measurements, take the cuvette and dispose of the solution waste into an appropriate waste container. Note: For autotitrator users, bring your own waste container for acids and bases and dispose them at your lab.
3. Report any issues and/or problems to Hugo Celio at hugo.celio@utexas.edu.
4. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the AFM

1. Attach the carbon tape or scotch tape to the dedicated sample holder.
2. Deposit the material on the adhesive tape in the fume hood.
3. Press the material down using a tweezer. Makes sure that the nanomaterial is sturdily fixed to the adhesive.
4. After measurements, bring the holder to the fume hood and dispose of the waste into an appropriate waste bad. Clean the sample holder with acetone, methanol and return it to the instrument.
5. Report any problems encountered to Raluca Gearba at gearba@austin.utexas.edu.
6. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the Raman

1. Adhere double sided carbon tape to a silicon or glass slide.
2. Deposit a small amount (few mg) of material on the carbon tape while working in the fume hood.
3. Firmly press the material down using a flat section of a spatula or a tweezer while covering the powder with some clean white support of the carbon tape. Tap sample on a solid surface to ensure material is sturdily fixed to the adhesive. Collect and dispose any excess powder that comes off from the carbon tape.
4. After measurements, take the sample holder to the fume hood and dispose of the waste into an appropriate waste container.
5. Report any issues and/or problems to Andrei Dolocan at adolocan@austin.utexas.edu.
6. Non-trained personal can assist to the procedure only if they wear the appropriate PPE.

Handling nanoparticles for the usage with the TEM Sample preparation equipment

1. Follow the general protocols for all work.
2. All powders, even if not designated “nanoparticles”, must be embedded in an epoxy prior to any mechanical treatment (cutting, polishing, grinding, etc..).
3. All mechanical treatments (cutting, polishing, grinding, etc..) should be done under a snorkel.
4. Clean reusable items (stubs) with Kim wipes and acetone followed by isopropanol.
5. Report any problems encountered to Karalee Jarvis at kjarvis@austin.utexas.edu.

"I have read and understand this SOP. I agree to fully adhere to its requirements. By signing below, I also acknowledge that I have received hands-on training for use of nanoparticles."

Last	First	UT EID	Signature	Date	Trainer Initials