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| **UNIVERSITY OF BRISTOL SCHOOL OF CHEMISTRY**  **RISK ASSESSMENT**  **This form must be completed by a competent assessor for any procedure/system of work before an attempt is made at carrying out the procedure/system of work. Please refer to the instructions for making a Risk Assessment in the** [**School of Chemistry Safety Manual**](http://www.chm.bris.ac.uk/safety/nfrass.htm) **(http://www.chm.bris.ac.uk/safety/nfrass.htm).** |
| **Name and Status of the Assessor:** Edmund Smith (PhD student) **Date:** 04/06/19 |
| **Activity/procedure being assessed:**  **Electrostatic spray deposition** of nano- and micro-particle colloidal suspensions |
| **Known or expected hazards associated with the activity:**   1. Electric shock from high voltages 2. Organic solvents (exposure or fire) 3. Nano- and micro-particles (exposure) 4. Silicon/diamond (or similar) substrates (sharp) |
| **The risk of injury and its severity likely to arise from these hazards:**   1. The risk of injury from electric shock in normal operation is medium, with the syringe being exposed while at high voltages. The risk is reduced as the syringe itself is insulating, but arcing can still occur if anything conductive comes into close proximity. The risk of electric shock from the components inside the apparatus is very low, as the interlock will not allow high voltages to be present while the apparatus is open.   The risk of injury from the high voltage power supply is very low since the hazardous high voltages are present only inside the power supply and cannot be accessed without opening the equipment casing, which ordinarily is neither required nor appropriate.  **The potential severity is very high (death).**   1. The risk of injury due to exposure to the solvents is low to medium, as the toxic hazards of inhalation and skin contact are minimised by careful handling and proper use of PPE. The risk of injury due to a solvent fire is minimal, as the quantities of solvent used are low (<5 ml). The potential severity of both exposure and fire is low given the small volumes used and is dependent on the solvent itself – users should make themselves aware of any hazards of the specific solvent used. 2. The risk of injury due to nanoparticles and microparticles is low, as exposure to these particles should only occur while they are in a colloidal suspension, and any risks are avoided with proper use of PPE. However, these colloids could form aerosols, which could be harmful if inhaled depending on the solvent and particles involved. The potential severity is low, but dependent on the particles used – users should make themselves aware of any hazards of the specific nano- or microparticles used. 3. Substrates are normally handled with tweezers to avoid contaminating or damaging them; thus, the risk of cuts is low. Since the sharp objects in question are very small, the potential severity of a cut from them is inherently limited. |
| **Who is at risk?**   1. Only research workers using the apparatus. 2. Research workers using the apparatus and anyone else working nearby. 3. Research workers using the apparatus and anyone else working nearby. 4. Only research workers using the apparatus. |
| **Measure to be taken to reduce the level of risk:**   1. The apparatus must not be touched while high voltages are being applied, and the grounding to the apparatus must not be disconnected. The interlock must not be defeated. At the end of deposition, the system must be left for at least one minute after the power supply has been turned off to allow for the static charge to dissipate.   All electrical items must be operated with no hazardous voltages accessible to users, and repair and maintenance of equipment must be performed by a competent person, and with electrical power completely disconnected wherever technically possible. Metal casings and other exposed parts of electrical apparatus must be connected firmly to earth ground to guard against possible dangerous faults. See reference 1.  **While high voltages are being applied, the apparatus must not be left unattended.**   1. Minimal quantities of solvent must be used and should only be used in well-ventilated areas away from potential sources of ignition. Spills must be cleaned up promptly. Bulk solvents must be stored in a suitable solvent cabinet, and wash bottles are to be of the vapour-venting type and stored appropriately. Protective gloves should preferably be worn to avoid skin irritation, and this is mandatory when the solvent used is methanol due to its established percutaneous toxicity. MSDS for the solvent being used must be read by the user. See also references 2 and 3. 2. Dry nano- and microparticles should only be handled in a glove box, and this is mandatory if there are any inhalation or percutaneous hazards on the MSDS for the particles. Spills must be cleaned up promptly. Protective gloves must be worn when handling colloidal suspensions, and they should only be handled in well-ventilated areas. 3. No further measures deemed necessary. If a cut is sustained, it is sufficient to wash with water (and optionally ethanol or isopropanol) and apply a sticking plaster. |
| **Training prerequisites:**  As required in the references.  **Untrained persons must never use the apparatus.** |
| **Level of risk remaining:**  Low, barring negligent behaviour. |
| **Action to be taken in an emergency:**  Turn off power to high-voltage supply at mains plug.  IN CASE OF INJURY, perform first aid if trained or contact a designated first aider. (A current list is provided at the Porter’s Lodge). If necessary, also contact security on extension 112233 (0117 331 1223) to call for an ambulance.  IN CASE OF FIRE, use a carbon dioxide fire extinguisher, one of which is provided in the laboratory next to the apparatus; two more are located in the corridor near to the door from which one enters S111. A water fire extinguisher is also available in the corridor if required. If the fire is too large to deal with in this way, evacuate the affected area, raise the fire alarm, and contact security on extension 112233 (0117 331 1223) to call the fire brigade. |
| **References:**  The following constitute an integral part of this risk assessment and must be reviewed along with the above.  Standard School of Chemistry risk assessments (see http://www.chm.bris.ac.uk/safety/compform.htm**)**:   1. Use of standard electrical equipment 2. Transport, Storage and Use of Solvents and other Flammable Liquids 3. Disposal of Waste solvents 4. Manual Handling |
| **Signature of Assessor: Supervisor’s signature:**    Edmund Smith Paul May |