Department of Engineering – Risk Assessment

Ref No. B974

Title of project/experiment/activity Use of microfluidic processors for carbon nanotube materials	
Location of activity EEDBA Annexe, Cambridge Graphene Centre, Chemistry Lab, Ground floor	**Start and end dates** 04/08/2017 - continuous

Brief description (or attach procedure/protocol)

A Microfluidizer is a homogenizer which converts fluid pressure into shear and collision forces that result in uniform particle size reduction or in multiphase mixing. Product enters the system via the inlet reservoir and is powered by a high-pressure pump into the interaction chamber, where high shear is applied, at speeds up to 400 m/s. It is then effectively cooled and collected in the output reservoir.

The equipment is located in Chemistry Lab. It is expected to be used for carbon nanotubes (CNTs) a few days per month for several hours at a time. The weighing and mixing of solutions will be done in the Chemistry Lab and Institute for manufacturing (IfM) CNT lab. CNTs are mixed with water, Pluronic F127 and PVA (Poly Vinyl Alcohol) and processed with microfluidizer to produce stable dispersions.

The M110-P Microfluidizers are commercially made systems for homogenization and will be used in accordance with the manufacturer's instructions.

NOTE: Due to different sealing materials in the microfluidizer, the only solvents that can be used are water, isopropanol, butanol (not ethanol or methanol), glycols, silicone oils. The use of these chemicals is covered by a separate risk assessment (RA). If you want to use these chemicals, check the relevant RA.

Hazard	Effect	Control measures	Residual risk
General hazards in lab	Inhalation of solvents Exposure to chemicals harmful to health	The dispersion solvents may be irritating to the eyes, respiratory system and skin. Gloves and goggles are worn to prevent skin and eye damage. The initial dispersion are prepared at a solvent wet bench. When using carbon nano tubes an extractor should be used and/or the inlet and outlet reservoirs sealed with a cover in place to prevent solvent vapours entering the open lab area. Other lab users will be using solvents with appropriate extraction in place (Likelihood: 1, Severity: 1) Gloves, eye protection and lab coat must be worn whilst in the laboratory. The Chemistry Lab rules will be respected.	Low risk
Carbon nanotubes	Causes serious eye irritation, May cause respiratory irritation, suspect of causing cancer.	Mainly harmful when in the powder form and get airborne. The precautionary principle is applied as there is not yet enough evidence to say whether CNTs cause cancer or not so the University treats them as though they could just in case. Weighing: CNT powders should only be opened in the "IsoPro Nano glove box" and weighed into a sealed receptacle so that it can then be returned to the solvent fume cupboard to add solvent for dispersion.	Low risk

		Solutions containing nanomaterials can then be handled outside the fume cupboard. To prevent exposure, only carbon nanotubes desolved in the solution will be used in the microfluidizer.	
Pluronic F127	Non-hazardous	According to Regulation (EC) No. 1272/2008, classed as a non-hazardous substance. When handling this substance, follow the general lab hazards rules.	No risk
PVA	Non-hazardous	According to Regulation (EC) No. 1272/2008, classed as a non-hazardous substance. When handling this substance, follow the general lab hazards rules.	No risk
Electric shock	Shock to user, damage to equipment	Do not get outer parts of microfluidizer wet. Clean up any spillages immediately. (Likelihood: 1, Severity: 1)	Low risk

Personal Protective Equipment required [*eye/face protection, respiratory protection, gloves, lab coat etc*]

Lab coat, gloves and eye protection (safety specs) required in the lab at all times

Emergency Instructions & First Aid

Spillage:
Spillage of the CNT powder in the open lab would require restricting access to the area, wearing an FFP3 dust mask (e.g. 3M 8835) and using wet wipes to clear it up. Dispose the wipe into the nanomaterials waste bin.

Solvent spillage or water-based dispersion spillages can be dealt by wiping with wipes. The wipes disposed into waste bins or should be left to dry (in the case of solvent spillage) in the solvent fume cupboard prior to disposal into waste bins.

Fire:
In case of fire, the fire alarm should be sounded and fire service called.

First aid:
General advice: Consult a physician. Show this safety data sheet to the doctor in attendance.
If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
In case of skin contact: Wash off with soap and plenty of water. Take off contaminated clothing and shoes immediately. Take victim immediately to hospital. Consult a physician.
In case of eye contact: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Any special monitoring required [*e.g. hearing test, vibration monitoring, health surveillance*]

No

Further control measures required? If yes, list with actions.

Waste Disposal Procedures: Carbon nanotube waste can only the disposed in the Carbon nanotube waste container.

Any other aqueous waste should be disposed in a container separate from solvent waste. Other solvents (IPA, butanol, glycols) will be disposed of in suitable non-chlorinated waste containers.

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In the case of equipment malfunction/failure: shutdown instrument and chiller from power buttons or directly from plug socket.
Biological/Laser/Radiation Approval [*requires relevant Specialist Safety Officer signature and date*] N/A
Out of hours/Lone working Microfluidizers can only be used during working hours.

Signature to confirm that this is a suitable and sufficient assessment of risk and that stated control measures are in place. This risk assessment should be reviewed if additional risks not covered in this assessment are identified or if there is any reason to indicate that the control measures are insufficient.

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Local Safety Coordinator	**Signature**	**Date** 4/8/17
Departmental Safety Office IAN SLACK	**Signature**	**Date** 23 AUG 2017