Department of Engineering – Risk Assessment. Ref No. B956

Title of project/experiment/activity Vacuum filtration of nanomaterial films	
Location of activity Cambridge Graphene Centre : Chemistry Lab	**Start and end dates** 24/08/2015 - continuous

Brief description (or attach procedure/protocol)

The vacuum filtration system consists of a glass funnels, flasks, diaphragm vacuum pump and heating oven.

The system is used to create films of graphene and other 2d crystals on polymer membranes starting from water or solvent based dispersions. The vacuum pump is used to quickly remove the solvent.

The membrane can be transferred to a different substrate (glass/ silicon) and dried in a heating oven. Then the membrane is dissolved using acetone and washed in isopropanol and water.

The diaphragm vacuum pump is a commercially available system and will be used in accordance with the manufacturer's instructions. The vacuum is ~1 mbar so risk of implosion is unlikely.
If solvents are used, the exhaust tubing should be inserted and fixed in place inside the solvent fume cupboard.

The ovens are also commercially available and will be used in accordance with the manufacturer's instructions.

Hazard	Effect	Control measures	Residual risk
Risk of ex-/ implosion	Shattering of glassware that may project towards user (risk of cuts)	Glassware should be inspected for flaws such as cracks, scratches, deep scoring and etching marks before using vacuum apparatus. Only use glassware and filter cones designed specifically for vacuum filtration. The apparatus should be clamped in place during use. Only diaphragm pump or in-house vacuum should be used with vacuum no higher than ~0.1 mbar. Pay attention during the installation of the system when handling glass components. (Likelihood: 1, Severity: 1)	Low risk
Heat: the oven can be heated to 300°C and the outer part of the vacuum pump can reach 80°C while working	If touched, the user may burn fingers	The drying of films should be performed at 70-80°C. The maximum temperature setpoint should be changed to 100°C using the red dial so that overheating will not occur. However, in the case that the temperature is increased, pay attention when removing samples from the oven. Heat-proof gloves are located on top of the oven for sample insertion/removal. Don't touch the outer part of the pump whilst in use. Keep the pump always connected and use the switch to turn on and off.	Low risk

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		(Likelihood: 1, Severity: 1)	

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

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

Emergency Instructions & First Aid

Spillage:
Water/solvent-based dispersion spillage should not be more than 60 mL, and can be dealt by wiping with cleanroom wipes. The wipes can be left to dry in the fume cupboard, if necessary, and disposed into waste bins.

Fire:
In case of fire, the fire alarm should be sounded and fire service called. If safe to do so, the fire may be extinguished using an extinguisher containing carbon dioxide, located in the corridor outside the laboratory.

First aid:
General advice: Consult a physician.

Minor cuts call for first aid while for Major cuts/mechanical injury call for ambulance. If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician. In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. 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: Aqueous waste should be disposed in a dedicated container separate from solvent waste. Solvents should be placed in the appropriate chlorinated or non-chlorinated waste bottles. All parts of the filtration system must be washed properly in the solvent fume cupboard sink. Nanoparticle waste should be dispose of separately.

In the case of equipment malfunction/failure: shutdown the instruments 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
The system cannot be used overnight.

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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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Name of Supervisor Prof A.C. Ferrari Email: acf26@cam.ac.uk	**Signature**	**Date** 2/11/16

Local Safety Coordinator	**Signature** David Hurle	**Date** 13/4/17
Departmental Safety Office IAN SLACK	**Signature**	**Date** 24 APR 2017