Department of Engineering – Risk Assessment Ref No. B964

Title of project/experiment/activity

Transfer of CVD Grown 2d Materials

Location of activity	**Start and end dates**
Cambridge Graphene Centre, Class 1000 Cleanroom, **EEDB Annexe, 2nd floor**	01/07/2017 – open ended

Brief description (or attach procedure/protocol)

Procedure for transferring CVD grown 2d materials to arbitrary substrates.

1. Spincoat polymer support layer on top of 2d material.
2. Etch the 2d material from the back side of growth substrate with the plasma etcher (separate risk assessment).
3. Etch growth substrate.
4. Prepare target substrates by cleaning or activating surface with plasma etcher (separate risk assessment).
5. Place samples onto target substrates and leave to dry.

Chemicals used in this process: Isopropanol, Acetone, Anisole, Ammonium Persulfate, Polymer resists: Poly-methyl-methacrylate (A4 950, A2 950, A8 495, A4 495)

Gasses used in this process: Nitrogen

Hazard	Effect	Control measures	Residual risk
Chemicals	Minor to serious injuries	Always wear protective equipment. Use dedicated fume hoods for handling acids and solvents. Wipes with a small amount of solvent may be used elsewhere in the laboratory using the wash bottles. Solutions are prepared adding chemicals to water. Dispose of chemicals in appropriate containers. Keep flammable solvents away from heat sources, hot plate, sparks, open flames, and other ignition sources. Weigh out toxic powder in glove box. Minimum amounts of acids and solvents will be used to reduce spills.	Low risk
Exposure to Inert Gases	Asphyxiation	All gas connections are checked regularly. Gas sensors for oxygen depletion are installed in the cleanroom and will detect any leakage early on.	Very low risk
Heat sources	Burns	If hot plate is hot (in use), other procedures must be carried out at sufficient distance to hot plate to avoid contact of skins. If it is left unattended, clear warning signs must be placed to alert other cleanroom users of hazard.	Low risk
Slips, trips, and falls	Minor injury	Ensure work area is free (as is practicable) from trailing cables, tools, materials, debris, and spills. All work should be from a suitable and stable work platform. Users must ensure they have the correct sized over-boots.	Low risk

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

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Clean room coveralls, gloves, safety goggles, and over-boots to be worn at all times, and the clean room rules will be respected.
Emergency Instructions & First Aid **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: 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. **Gas Leak:** In the case of a gas leak the flow controller should be closed, as should the forming gas cylinder. If the leak triggers the clean room gas alarm, then the clean room should be evacuated **Burn:** In the event of burn, rinse with running water and seek first aid if necessary.
Any special monitoring required [*e.g. hearing test, vibration monitoring, health surveillance*] N/A
Further control measures required? If yes, list with actions. **Chemicals/Gases/Substances –**
Biological/Laser/Radiation Approval [*requires relevant Specialist Safety Officer signature and date*] N/A
Out of hours/Lone working N/A

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.

Name of Assessor Hannah Watson Email: hfyw2@eng.cam.ac.uk	**Signature**	**Date** 7 July 2017
Name of Supervisor Prof. A.C. Ferrari Email: acf26@cam.ac.uk	**Signature**	**Date**

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Facilities Manager Dr Yury Alaverdyan Email: facilities@graphene.cam.ac.uk	**Counter-signature**	**Date** 11/7/17

Local Safety Coordinator	**Signature**	**Date** 11/7/17
Departmental Safety Office IAN SLACK	**Signature**	**Date** 27 JUL 2017