Electron Beam Lithography Access FAQs

How much does it cost to use the instrument?
It is free of charge for any users from UK universities. We will also pay for all associated travel and subsistence costs.

How do I apply for access?
Fill out and submit the on-line contact form. Proposals will be considered by the Nanofabrication Facility Advisory Group consisting of Prof. Simon Bending, Dr Steve Andrews, Dr Philip Shields and Dr Stephen Wedge. The evaluation process will be consistent with EPSRC’s policy on confidentiality (see “Confidentiality of our Assessment Process”).

What are the deadlines for applying for access?
There are no deadlines. Applications can be received at any time and will normally be considered within 72 hours of first contact. Subject to a positive evaluation we will attempt to schedule the job within two weeks of the first enquiry (subject to availability).

What criteria will be used to evaluate applications for access?
(i) the scientific merit;
(ii) the appropriateness;
(iii) the feasibility of the proposed work.

How long should I book the instrument for?
We anticipate that most jobs will use blocks of 2-3 consecutive days, more if significant process development/evolution is required and/or access to supporting processes. Advice will be given on this after the application has been considered by the Advisory Group.

What are the detailed specifications of the electron beam lithography system?
Our electron beam lithography system is built around a Hitachi S-4300 scanning electron microscope with a thermal Schottky field emission electron gun and incorporates a high speed electrostatic beam blanker. The thermal field emission source is vital for achieving high (up to 25nA) and very stable beam currents. The microscope operates with acceleration voltages in the range 0.5-30kV and has a spatial resolution of 1.5nm at 30kV (WD 5mm). It is fitted with an LST 100 50mm×50mm laser interferometer stage capable of writing over 50mm wafer areas with alignment accuracy <80nm. Direct writing is enabled with the Raith ElphyPlus professional lithography attachment. Writing to scan coils is achieved with 16 bit DSP hardware which integrates control of the beam blanker and stage (for step and repeat processes).

What is the smallest feature I can pattern?
The electron beam lithography system is routinely used to pattern structures with dimensions down to ~50nm in PMMA (a common electron-beam resist). Smaller features are possible, but depend crucially on the type of resist used, the substrate material and additional processing requirements (e.g. etching of underlying films or ‘lift-off’ of deposited films). Achieving feature sizes <50nm will involve considerably more effort and more time should be allowed for process development.

How do I define in software the structures to be patterned?
A range of data formats can be used or converted with our pattern generator. We routinely use the CAD packages WaveMaker and Clewin to design our masks and store and import designs in GDSII format. A stand-alone PC running WaveMaker is available in Bath for pattern design, and expert advice will be provided on this upon arrival. Alternatively users can attempt to design patterns using their own software (e.g. AutoCAD) and e-mail them to us prior to use for checking.

What additional processes are available in addition to electron-beam lithography?
Users will also have access to wet or dry (reactive ion etching and Ar ion milling) etching and various thin film deposition techniques (electron beam and thermal evaporation, PECVD, dual ion beam sputter
What materials can be etched by the available dry/wet etching techniques?
Dry etching is performed in our Oxford Plasma LAB 80 Plus and PlasmaPro System 100 inductively coupled plasma (ICP) etchers. Currently this is configured to use the following gases: O₂, Ar, SiCl₄, Cl₂, BCl₃, CHF₃ & SF₆, and recipes are well established to etch GaN, GaAs, Si, SiO₂, Si₃N₄ & many thin metallic films. In addition we have broad experience with a wide variety of wet chemical etchants which may be required, e.g. HF-based solutions for etching novel photonic fibres.

What materials can be deposited by the available thin film deposition techniques?
A broad range of metals and alloys can be evaporated from our Edwards thermal (Auto 306) or electron beam (FL 400) coaters. Si₃N₄ and SiO₂ dielectric films can be formed by plasma-enhanced chemical vapour deposition (Plasma Therm 790 - PECVD). SiO₂, Al, Ti and various other oxides or metals can be deposited in our dual ion beam sputtering unit (Nordiko 3000 / M DBIS).

What assistance will be offered during user visits?
Expert assistance will be provided at all stages of the work including (i) expert support for process design, (ii) expert support for CAD pattern design and (iii) expert hands-on technical assistance with resist preparation, lithography and additional processes.