

Job Description

Job Title:	Micro and Nanofabrication Process Engineer
Department:	Institute for Quantum Computing
Reports To:	Nanofabrication Process Engineering Manager
Jobs Reporting:	N/A
Salary Grade:	USG 12
Effective Date:	May 1 2017

Primary Purpose

The Micro and Nanofabrication Process Engineer is a professional level staff person, responsible for process evaluation for all lab equipment located in the Quantum NanoFab Core Infrastructure. As part of the process evaluation mandate the Micro and Nanofabrication Process Engineer is also expected to be the primary process consultant for lab members and be a front-line troubleshooter assisting lab members with their failed processes. This position plays a critical role in the success of the open access facility by conducting assessment, development and maintenance of complex fabrication processes and technologies within the facility. The Quantum NanoFab is unique in that it enables the fabrication of leading edge quantum and nano structures and devices. It serves the needs of two institutes, the Institute for Quantum Computing (IQC) and the Waterloo Institute for Nanotechnology (WIN), as well as multiple local startups and national industrial & academic clients. At any given time the facility's customer base includes over 200 independent and demanding users (composed of Post Docs, graduate students & private researchers) under 30 to 50 Principal Investigators. The facility's annual operating budget is on the order of \$1M; approximately \$500k in user fees are invoiced annually. It is one of the best equipped and advanced cleanroom labs in North America, containing a comprehensive suite of state of the art lithography, deposition, diffusion, etch, packaging and characterization equipment distributed throughout it's cleanroom and satellite labs. In particular, the Quantum NanoFab contains an Electron Beam Lithography toolset that is unparalleled in Canada, a technology that is critical in the fabrication of quantum and nanoscale devices. The broad range of leading edge fabrication technologies enables researchers to conduct research at the highest international level. The highly specialized nature of these technologies make it imperative that the incumbent maintain an up-to-date knowledge of emerging equipment and process technologies to provide the greatest possible value to the facility's end users.

Key Accountabilities

Process Development

- The candidate is responsible for establishing a series of baseline fabrication recipes on each of the major pieces of fabrication equipment listed. This requires that the candidate interact with equipment manufacturers as well as resident expert technical staff to identify initial equipment operating parameters. Through design of experiment methods, the incumbent must fine tune these parameters in order to establish robust process windows on each piece of equipment. All recipes must be thoroughly documented by the incumbent.
- As lead process developer, the candidate interacts with facility staff and uWaterloo researchers to identify the most needed process modules. He/She ultimately integrates baseline recipes into such modules.
- Monitor user needs via continuous interaction with the community and coordinate and lead recipe/process development initiatives as needed.
- Provide technical leadership in the definition and documentation of technically challenging processes such as Electron Beam Lithography pattern overlaying on top of existing UV lithography defined structures.

Equipment Instruction

- Instruct graduate research students and other users in the use and operation of the fabrication equipment.
- Qualify and instruct lab users to ensure safe and optimal equipment use.
- Provide demonstrations as needed to ensure optimal equipment use.
- Establish & maintain policies for equipment operation and handling of materials.

Job Description

<ul style="list-style-type: none"> • Document equipment operating manuals and maintenance procedures, changes in hardware/software setups and newly established recipes. • Develop fabrication equipment operating policies based on current needs, industry best practices, university guidelines and QNC fabrication team policies.
Safety <ul style="list-style-type: none"> • Enforce all health and safety guidelines in accordance with UW & facility protocols. • Instruct new fabrication facility users on cleanroom and health & safety protocols.
Process Evaluation and Consultation <ul style="list-style-type: none"> • Evaluate process flows and equipment process submissions to ensure feasibility and compatibility. • In conjunction with management, allow/deny user access to equipment based on compatibility and contamination considerations. • Provide support and guidance for users in planning new processes.
Process Maintenance and Statistical Process Control <ul style="list-style-type: none"> • Demonstrate equipment stability and repeatability via the establishment and routine running of statistical process control (SPC) mechanisms. • Plan new SPC's based on continuously changing user needs. • Continuously monitor equipment cleanliness and process compatibilities to ensure optimal infrastructure performance. Initiate corrective actions as needed.

Required Qualifications

Education <ul style="list-style-type: none"> • PhD degree or Masters degree and equivalent experience.
Experience <ul style="list-style-type: none"> • Minimum 5 years experience developing and running advanced integrated circuit (IC) or MEMS nanofabrication processes in well-established, world-class industrial or academic device fabrication environments. Proven ability, solid hands-on and theoretical materials and semiconductor knowledge & experience. Extensive practical and applied knowledge and experience with state-of-the-art nanofabrication equipment. The incumbent must be intimately familiar with the operation and development of recipes run on all classes of equipment. Solid demonstrated written & oral communication skills and good interpersonal skills are required to succeed.
Knowledge/Skills/Abilities <ul style="list-style-type: none"> • Broad experience with the operation and fine tuning of nanofabrication recipes on all types of Silicon / IC fabrication tools (UV lithography, E-beam lithography, high temperature furnace and rapid anneal, high vacuum deposition systems, PVD and CVD film deposition systems, wet process stations, plasma etch tools, device packaging, etc.). The incumbent must have good knowledge of characterization techniques as required to diagnose silicon/IC & MEMS nanofabrication process issues (such as Electron Microscopy, Optical Microscopy, Stylus or Optical Profilometry, XPS or EDX Spectroscopies, Atomic Force Microscopy, Ellipsometry and X-ray Diffractometry). Experience with design of experiments (DOE) and analysis methodologies. Solid knowledge and application of chemical safety, gas safety, general lab safety and cleanroom hygiene best practices is essential. Expertise and command of GDS-II computer aided design software is important.

Nature and Scope

- **Contacts:** interacts closely with lab members who are performing work in the Quantum NanoFab. Interacts externally with technical and process personnel from equipment vendors and lab members who may be external to the UW campus. Also interacts and participates in conferences or communities of individuals working at similar institutions through LabNetwork mailing list or, EIPBN and UGIM conferences.
- **Level of Responsibility:** Responsible for reviewing new processes and samples admitted into the Quantum NanoFab and ensuring they do not interfere with existing process and equipment operation. Responsible for monitoring equipment health through SPC testing and with help of Quantum NanoFab management initiating remedial action. Equipment value is on the order of \$21M, installed in a \$26M purpose-built state-of-the-art nanofabrication cleanroom facility, so maintaining functioning equipment and helping lab members make

Job Description



effective use of said equipment is of great importance. Responsible for consulting with and instructing new lab members in safe and effective equipment use. The candidate's technical abilities will influence and assist all lab members in the Quantum NanoFab.

- **Decision-Making Authority:** Authority to make decisions regarding admission of new samples and new processes into the Quantum NanoFab. The candidate is to review and approve of all work that lab members aim to conduct in the Quantum NanoFab. If candidate is unsure of admitting a new process or challenged on their decision they may escalate to the Nanofabrication Process Engineering Manager and above that to the Quantum NanoFab Management Group.
- **Physical and Sensory Demands:** Extensive time may be spent sitting in front of equipment, requiring focused observation. Much of the time is spent working in a physically taxing cleanroom environment where cleanroom gowning (head to toe) must be worn. Extended periods of time may be spent in yellow lighting conditions. Much of the work can be accomplished sitting in a comfortable position with frequent opportunity to move about. Occasional lifting (up to 40lbs) may be required.
- **Working Environment:** Long hours may occasionally be called for to run a given process under development from beginning to end with minimal interruptions or delays. There are deadline pressures, while at the same time there is a demand for thoroughness, accuracy and acute attention to detail.