

Job Description

Job Title:	Nanofabrication and Characterization Scientist
Department:	Institute for Quantum Computing
Reports To:	Nanofabrication Process Engineering Manager
Jobs Reporting:	None
Salary Grade:	USG 11 - 37.5hr / wk
Effective Date:	November 16, 2017

Primary Purpose

The Nanofabrication and Characterization Scientist is a professional level staff person, responsible for process support, training, and user service on all characterization tools available in the Quantum NanoFab Core Infrastructure. As part of this mandate the Nanofabrication and Characterization Scientist will assist Quantum NanoFab members apply characterization techniques such as Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS), Atomic Force Microscopy (AFM), Ellipsometry, etc. for the purposes of troubleshooting and characterizing their fabrication processes. The Quantum NanoFab is unique in that it enables the fabrication of leading edge quantum and nanostructures 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 and academic clients. The facility's annual operating budget is in excess of \$1M; approximately \$500K in user fees are invoiced annually. It is one of the best equipped and most advanced cleanroom labs in North America, containing a comprehensive suite of state of the art lithography, deposition, diffusion, etch, packaging and characterization equipment.

Key Accountabilities

Lab member guidance, consultation and training

- Instruct researchers in the use and operation of fabrication and characterization equipment.
- Provide hands on training/qualification for lab members on all pieces of characterization equipment.
- Provide demonstrations as needed to ensure optimal equipment use.
- Review newly proposed samples protocols or techniques to ensure their feasibility and determine if any risks to tool operation are present.
- Generate documentation as needed to aid lab members in operation of characterization equipment, this includes but is not limited to the generation of standard operating procedure manuals (SOPs). Incumbent is also responsible for revision and maintenance of said documentation (including SOPs).
- Document equipment operating manuals and maintenance procedures, changes in hardware/software setups and newly established protocols/recipes
- Consult with lab members to assist them in determining their characterization needs.
- Work with lab members to assist them in interpretation of characterization results and applying these findings towards resolution of fabrication issues.
- Serve as "resident expert" for all of the lab's characterization tools. This entails self-directed learning and practice in order to master the advanced features of these pieces of equipment. Documenting and disseminating the results of these learnings are imperative in enabling the Quantum NanoFab community to make excellent use of these tools.
- Interact with equipment vendors to implement new or advanced capabilities within characterization toolset.

Service

- On occasion incumbent may be asked to perform hands-on work on behalf of lab members or remote users who require characterization services.
- Provide technical expertise and consultation for remote users.
- Provide cost estimates for hands-on work being performed for lab members or remote users.

Equipment maintenance and performance

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- Manage Statistical Process Control (SPC) initiative, monitoring equipment performance across characterization toolset.
 - Identify and generate tests in order to monitor equipment performance.
 - Manage remedial action/repairs when significant degradation in equipment performance is uncovered by SPC analysis.
 - Consult with local equipment technicians and remote vendor engineers to assist them during repair and preventative maintenance work.
 - Perform “quick response” repair/troubleshooting service if lab members experience minor issues with equipment operation.
 - Establish and maintain policies for equipment operation and handling of materials to ensure high quality results and maintain equipment health.
 - Develop fabrication/characterization equipment operating policies based on current needs, industry best practices, university guidelines, and QNC fabrication team policies.
- Maintain an inventory of parts and supplies to enable characterization toolset operation.

Safety

- Enforce all health and safety guidelines in accordance with UW and facility protocols.
- Instruct new fabrication/characterization facility users on cleanroom and health & safety protocols.

Required Qualifications

Education:

- PhD degree or Masters degree in Chemistry, Physics, Electrical Engineering or Chemical/Materials Engineering

Experience

- Minimum 3-4 years experience working with integrated circuit (IC) or MEMS fabrication processes is required. Demonstrated experience applying characterization methods such as SEM/EDS, AFM and ellipsometry to the troubleshooting of IC or MEMS fabrication processes is essential. It is expected that the incumbent will be intimately familiar with the outlined characterization techniques (SEM/EDS, AFM, Ellipsometry) as well as any other typical microscopy or spectroscopy techniques that may be applied to the characterization of IC and MEMS devices.

Knowledge/Skills/Abilities

- Incumbent must have significant experience with a modern Scanning Electron Microscope (SEM) tool. Ideally the incumbent will have significant experience with SEM/EDS, Atomic Force Microscopy (AFM) and Ellipsometry. Experience in running IC or MEMS fabrication equipment is highly useful, as he/she will be helping to characterize samples generated by these pieces of equipment. The incumbent will be working primarily with the Quantum NanoFab’s JEOL JSM 7200F SEM, Oxford Instruments AZtecEnergy EDS, Bruker Fastscan AFM, and Woollam M2000DI Spectroscopic Ellipsometer.

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 technical conferences.
- **Level of Responsibility:** This position is responsible for helping to maintain the performance of highly valuable equipment in the Quantum NanoFab by regular proactive testing and by quickly responding to problems that have been noted by lab members. This position is ultimately responsible for assisting lab members in characterization tasks so that they may quickly troubleshoot and diagnose problems with their fabrication processes. The position entails initial supervision of lab users (graduate students, post-docs) until they have reached a sufficient level of proficiency. The job has defined highly-specialized work, with minimal supervision and provides guidance to many others in the lab.
- **Decision-Making Authority:** The incumbent is expected to work independently in carrying out all tasks under their scope. In complex or unusual situations the incumbent is expected to seek assistance both within and outside the Quantum NanoFab team as required.

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- **Physical and Sensory Demands:** Extensive time may be spent sitting in front of consoles for the JEOL Scanning Electron Microscope, Bruker Atomic Force Microscope and Woollam Ellipsometer. Working at these consoles sometimes requires prolonged, focused observation to conduct characterization tasks. In the course of receiving/shipping/installing new machine components this position may require the lifting of objects up to 40lbs.
 - **Working Environment:** Much of the time is spent working in a cleanroom environment where cleanroom gowning (head to toe) must be worn. Extended periods of time may be spent under yellow lighting conditions. Long hours may occasionally be called upon to complete characterization work in a timely manner to serve process or equipment troubleshooting. There are deadline pressures, while at the same time there is a demand for thoroughness, accuracy, and acute attention to detail. Much of the work can be accomplished sitting in a comfortable position with frequent opportunity to move about.