

Idaho Incubation Fund Program

Progress Report Form

Proposal No. IGEM16-02
Name: Kurtis Cantley
Name of Institution: Boise State University
Project Title: Enhancing Capabilities in Microfabrication at Boise State
Reporting Period: July 1, 2015 to January 29, 2016

Information to be reported in your progress report is as follows (attach additional information as needed):

1. Summary of project accomplishments for the period just completed and plans for the coming reporting period:

From the start of funding in September 2015, we immediately began the process of purchasing year 1 equipment and supplies as well as starting work on facility infrastructure upgrades. A list of related project objectives and outcomes is:

- Purchase of a Bruker Dektak XT-A stylus profilometer for measuring nanometer to micrometer height variations in semiconductor samples. This equipment arrived and was installed at the end of September and has already found heavy internal and external use, including an hourly contract with American Semiconductor, Inc.
- Purchase of laboratory consumables including a gold sputtering target which is used to support various faculty research projects.
- Upgrade of the Hitachi 4500 scanning electron microscope (SEM) which is currently the highest resolution SEM at Boise State.
- Installation of additional and replacement of some old de-ionized water plumbing to increase the quality of clean room water.
- Examined the feasibility of adding end point detection to the Veeco inductively couple plasma etcher (ion mill). Unfortunately, although this item was included in the year 1 budget, no vacuum port is available for attachment of such an instrument. Purchase of similar equipment for this instrument or the similar Oxford PlasmaLab 100 etcher will be re-evaluated in year 3.
- In place of the end point detector, purchase of the Fuji Dimatix materials inkjet printer originally scheduled for year 3 was moved forward. This decision was made primarily in response to interest in the tool both from Boise State faculty as well as several local companies including American Semiconductor, PakSense, Simplot, PKG, Biomark, and others.
- Full refurbishment of the vacuum pump for the CHA thermal evaporation deposition system.
- Purchase of all supplies including stainless steel tubing for an ultra-pure nitrogen distribution system inside the clean room.
- Full clean room-compatible window tinting to eliminate all UV light from the lithography bay and improve patterning results.

- Initiation of the hiring process for both the technical support engineer (near completion) and the new ECE faculty member (phone interviews completing by February 12, 2016).
- Purchase of three wet chemical processing stations (acid, base, and solvent) from Boise-based JST Manufacturing, Inc. The initial proposal called for purchase of only two benches, but the company was able to offer a significant discount as well as an upgrade to a gently used bench, resulting in the same total cost. Together, these three pieces of equipment will significantly increase the usability and safety factor of the facility, and include advanced capabilities such as automated touch screen process control, advanced spin-coating station, ultrasonic heated processing bath, integrated hot plates, and handheld sprayers for de-ionized water and ultra-pure nitrogen.

2. Summary of budget expenditures for the period just completed (include project burn rate):



As of January 29th, 2015, approximately \$414,000 of the \$500,000 year 1 budget has been encumbered or spent. For the five months since receiving funds, that corresponds to a **burn rate of approximately \$83,000/month**. However, large purchases make that rate quite varied. These major items include:

- \$47,500 for the Fuji Dimatix DMP-2831 Materials Printer
- \$52,000 for the Bruker Dektak XT-A stylus profilometer
- \$187,707 for the three new wet chemical processing stations from JST Manufacturing, Inc.
- \$36,404 in total for supplies for facility and equipment upgrades
- Approximately \$40,000 in salary and associated fringe for IML staff, with \$52,000 remaining (counted in the encumbered amount).

Several other items are still expected to be purchased including safe chemical storage cabinets for acids, bases, and solvents to accompany the new wet benches, clean room tables for the profilometer, computers, an upgraded optical microscope with digital camera, as well as several facility and infrastructure upgrades (electrical, nitrogen, chilled water, etc.). The total cost of the listed physical items is expected to be on the order of \$25,000.

3. Numbers of faculty and student participation resulting from the funding, including internships:

Currently, there are no students or faculty supported directly by this project. As stated in part 1, the faculty hiring process has been initiated and there were 64 applicants in all. Of these, 12 are scheduled to be interviewed by phone in the first two weeks of February 2016, and on-campus interviews of 3-4 candidates will take place in March 2016. Once the new faculty member officially begins their appointment in August, funds will be used for their specific research start-up needs, as well as for the stipend and fees of two ECE graduate students for the remainder of the project.

4. List patents, copyrights, plant variety protection certificates received or pending:

None at the current time.

5. List technology licenses signed and start-up businesses created:

At this time there are no start-up businesses created as a result of the funding. However, memristor (resistive memory) technology developed by Prof. Kris Campbell in the ECE department has been licensed by Knowm, Inc. and M. Alexander Nugent Consulting (MANC) of Santa Fe, NM. If their projects proceed as expected, as much as \$100,000 could be spent in the IML over the next few years.

6. Status of private/industry partnerships (include enough information to judge level of engagement):

Several new agreements with Idaho businesses have been put in place since the start of the project to use the IML and new equipment and processes contained in it. These include:

- American Semiconductor, Inc. (Boise, ID), which has used the new Bruker stylus profilometer for approximately 6 hours (>\$200) during the first three months of ownership of the tool.
- Fiberguide, Inc. (Caldwell, ID) has spent ~\$1300 using the current wet bench for process development and anticipates heavy use of the new benches when they arrive.
- Collaborative use of the Bruker stylus profilometer (~\$1500 spent to date) for a joint project with Idaho National Laboratory (INL), with additional use planned for the future.

7. Any other pertinent information that will indicate to the council that the project is meeting satisfactory progress.

On-site interviews of the new technical support engineer have begun and we expect to extend an offer to one of these very qualified candidates within the next week. Phone interviews for faculty will be completed in approximately two weeks, and on-campus interviews are expected to finish by the end of March so a competitive offer can be made early in the faculty recruiting cycle.