

November 20, 2006

It is clearly recognized that we have a number of issues related to the metallization systems in the Birck Nanotechnology Center that are contributing to delays and lost time on research projects. An excellent discussion was held during the Metallization User Meeting held on 3 November 2007, and several meetings and brainstorming sessions have followed that meeting. The following conclusions and action plans have evolved from those discussions.

There are two major areas that are the root cause of the equipment downtime and metallization quality issues, aging equipment and user error. User error can be broken down into three sub-categories: mistakes due to lack of knowledge; mistakes due to short-cuts and “rushing” a process; and deliberate modification or attempted equipment repair by unqualified individuals. We plan to use a four-pronged approach to address these issues.

First, work is underway to replace certain key pieces of aging equipment with more capable equipment. Currently, we are “fundraising” among users to assist in the purchase of a new evaporation system to replace the Varian evaporator. As you may be aware, the Varian was obtained in 1961 and while modified many times, it is now just “worn out.” As a replacement, we are purchasing individual components and building up a custom evaporator that meets the needs of the BNC users. This allows us to use new components, and also allows us to build what is truly a research-oriented machine rather than modifying a production-type system as we have done in the past. Please understand that we must use the approved Purdue procurement procedures, then assemble the unit, so it will be several months before the new system is on line.

Through the efforts of Tim Fisher, we are also in the process of moving a highly capable sputtering system into the facility. This system, while far from new, is in very good condition and will greatly enhance our metal deposition capabilities. The addition of these two pieces of deposition equipment is expected to relieve a significant amount of pressure from the other systems, enhancing their up-time and capabilities.

The second action area addresses the issue of mistakes caused by lack of knowledge. We have reexamined our training program and discussed concepts of a Super-User program with faculty, students, and staff. Using all these inputs, we are drastically revising the way we train people on the metallization systems. This new training approach will be used on metallization systems as a pilot program, and will eventually be expanded to other equipment training.

A Super-User is an experienced user of the equipment who has been jointly designated by the staff member(s) responsible for the equipment and the faculty advisor/supervisor of that user. The Super-User may be a student or a post-doc, and will serve a dual role as a mentor to others using the system and as a concerned user overseeing the system. It is expected that the Super-Users on a given piece of equipment will work very closely with the staff member(s) assigned to the equipment. It should be noted that a Super-User is *not* empowered to repair or modify equipment.

Super-Users will receive special training on the equipment from the staff, and should have a significantly better knowledge of how the equipment works and why it works that way following this training. A reward for Super-Users has also been discussed. I am ambivalent on this subject, and would appreciate input in this regard. There is, of course, the implicit reward of having this distinguishing item on their resume. As someone who has hired engineers over the past 25 years, this type of designation gives an advantage when sorting through resumes and in making a hiring decision.

One other reward that we could readily provide and that seems very practical is to allow priority in equipment scheduling for Super-Users. Please communicate to me any other considerations that might be appropriate to motivate someone to become a Super-User.

The first step in the new approach to training includes an appeal to faculty members. A very significant percentage of the new users do not have an answer to the question, "Why do you want to use this equipment?" The answer is often, "My advisor told me to be trained on it." It is difficult to establish a motivation on the part of the user when they do not understand what a piece of equipment does and how it fits into the research that they are doing. I would request that the advisor explain to each student what they are using a piece of equipment for and how it will impact their research.

A second request is in regard to the timing of the training. We have had problems with students who receive training on a piece of equipment four to six months prior to its use. Unfortunately, it is nearly impossible for most students to retain the information over that period of non-use. Training should be provided in as close a time proximity as practical to the actual use of the equipment.

Under the new training approach, an on-line course will precede any hands-on training. This course will be a self-paced course with tests integrated into the program. As many simulations as practical will also be included. Following successful completion of the on-line course, the trainee will sign up for an overview training program conducted by a staff member. After successfully completing the overview training, the user will work with a designated Super-User to increase competence on the system and understanding of the system. The user will be required to work with the Super-User on five separate depositions. These depositions may involve the Super-User's material or the trainee's material, at the option of the Super-User.

It is expected that the first work with the Super-User will be the Super-User performing the runs while the trainee observes, where toward the end of the five runs it will be the trainee performing the runs under the observation of the Super-User. The Super-User has the option of crediting the trainee with the run, or if the trainee is negligent or inattentive, withholding credit for the run.

Once the five runs have been completed, the trainee signs up with a staff member to be checked-out on the equipment. During the check-out process, the staff member will observe the trainee making a deposition, and question the user about what s/he is doing and why s/he is doing it. If the check-out process is successful, the trainee will now be a qualified user and will be allowed to sign up for the equipment to make independent runs.

The third action item is designed to address the "rushing" and "short-cutting" of existing procedures. This item has two parts. First, the log sheet will be expanded to include key timing points that must be filled in. If a user does not completely fill in the log sheet, they will be suspended from the use of the equipment for one week. A second offence doubles the suspension and a third offence results in a semester suspension. Second, the training program will include, as much as practical, the consequences of rushing or short-cutting the system. It will be made clear to trainees that rushing a particular operation or short-cutting a time or a sequence of events can cause contamination to their sample and can result in significant equipment downtime.

The fourth and final action item addresses the person repeatedly short-cutting operations and the person who deliberately modifies or attempts to modify equipment. Video cameras have been placed at strategic locations to identify perpetrators of these events, and sanctions ranging from one-week suspensions to permanent expulsion from the equipment will be imposed. Repeated violations of short-cutting procedures would likely result in a one-week suspension, but modification of equipment is far more serious. These systems have safety implications, and modifications can unwittingly defeat the safety features that protect the user and the person maintaining the equipment. For this reason, it is

recommended that a permanent suspension be applied to someone who deliberately modifies equipment without consent of the staff member in charge of that equipment.

Comments and suggestions related to this overall approach and to specific items are solicited. We will be implementing this new program in stages as we complete each of the action items, but will address all of these items with the significant level of urgency that they deserve. Please respond to the undersigned – by e-mail or personal discussion – at your earliest availability.

Thank you for all of the inputs that you have provided and for your support of these new initiatives. I believe that by working together we can have a dramatic impact on both the uptime of the systems and the quality of the films provided by the system.

Sincerely,

John Weaver

John R. Weaver
Facility Manager
Birck Nanotechnology Center