STANFORD UNIVERSITY

STANDARD OPERATING PROCEDURE TEMPLATE

#1	**CONTACT INFORMATION:**

Procedure Title	**Impedance Analyzer User Protocol**
Procedure Authors	**Yu-Hung Li & Sang Jong Kim**
Date of Creation/Revision	**11-12-2011**
Name of Responsible Person	**Jeffrey B. Tok**
Location of Procedure	**Nano Bldg, Rm 008**
Approval Signature	*(If required. See section #10 of this template)*

#2	**THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:**

☒ **Specific laboratory procedure or experiment**
Agilent 4294A Precision Impedance Analyzer

☐ **Generic laboratory procedure that covers several chemicals**
Examples: distillation, chromatography, etc.

☐ **Generic use of specific chemical or class of chemicals with similar hazards**
Examples: organic azides, mineral acids, etc.

#3	**PROCESS OR EXPERIMENT DESCRIPTION**

Provide a brief description of your process or experiment, including its purpose. Do not provide a detailed sequential description as this will be covered by section #6 of this template. Indicate the frequency and duration below. *[PRECEDING GUIDANCE TEXT MAY BE DELETED.]*

Frequency:	☐ one time ☐ daily ☐ weekly ☐ monthly ☐ other:_____
Duration per Expt:	___**15**___ minutes; or _____hours

#4	**SAFETY LITERATURE REVIEW & HAZARD SUMMARY**

Dangerous voltage levels, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, or adjusting this instrument.

1. To avoid hazardous electrical shock, do not turn on the Agilent 4294A if there are signs of damage to any portion of the outer enclosure (for example, covers, panel, or display). The instrument chassis and cabinet must be grounded with the supplied power cable's grounding prong.

2. For protection against electrical shock, the power cable grounding prong must not be removed. The power plug must be plugged into an outlet that provides an appropriate receptacle for the ground connection.

3. Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment clearly constitutes a safety hazard.

4. Operators must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltage levels may exist even with the power cable removed. To avoid injuries, always disconnect the power and discharge circuits before touching them.

#5	**STORAGE REQUIREMENTS**

N/A

#6	**STEP-BY-STEP OPERATING PROCEDURE**

1. Log in on CORAL and sign in logbook.

2. Connect the correct adapter or SMF's 42941A Impedance Probe Kit and your test fixture (See Figure). More adapter options are included in "Impedance measurement accessory selection guide".

3. Turn on the main power.

4. Before all measurement, calibrate the adapter and fixture in open-circuit and short-circuit modes. Procedures are:
   a. Press "Cal"
   b. Choose the adapter you connected and press "return"
   c. Press "FIXTURE COMPEN" to calibrate your fixture:
      - short your fixture and then press "SHORT"

- open your fixture and then press “OPEN”

5. Perform measurement. Procedures are:
   a. Choose the function you want to measure by pressing “Meas”
   b. Choose the frequency range of your interest (min: 40Hz, max: 110MHz)

6. To save your data in a floppy disc, perform:
   a. Insert a floppy disc
   b. Press “Save” → “STORE DEV” → “FLOPPY”
   c. Choose the type of the data you want to save (measurement state (set-up); graphs in .tif; data in .txt)
   d. Enter the file name you would like to have.
   e. Data can be saved in the machine and can be downloaded through FTP.

7. After completing measurement, turn off the main power.

8. Disconnect your adapter/fixture and clean up the area.

9. Sign off in logbook and disable equipment from CORAL.

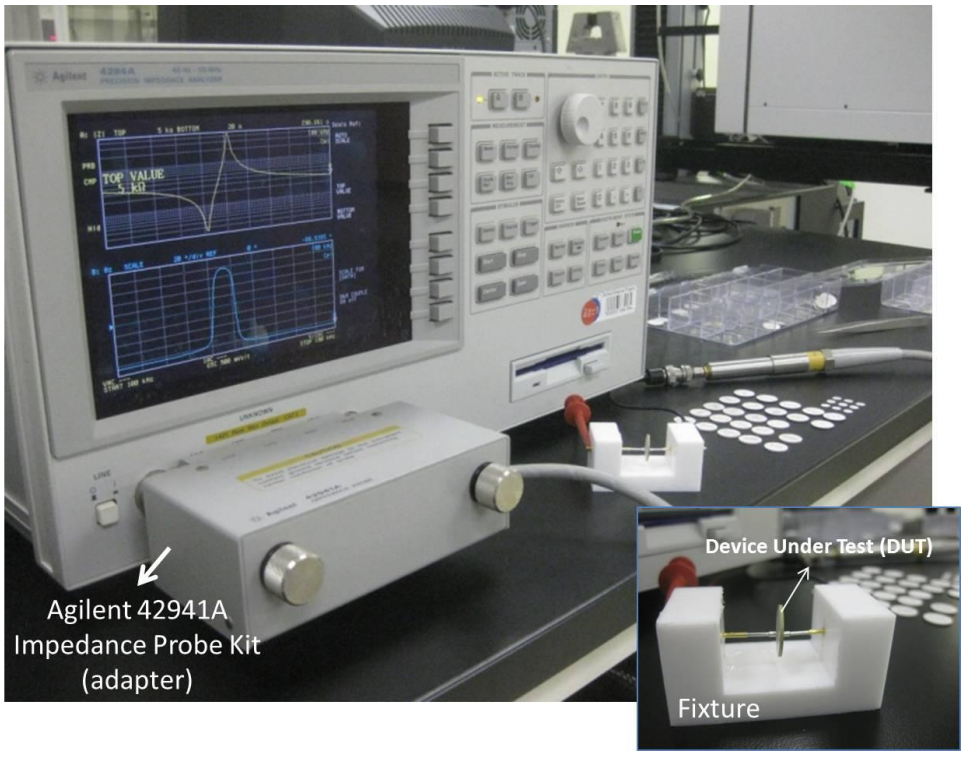

Figure: SMF's Agilent Impedence Analyzer.

Step-by-Step Description of Your Process or Experiment	Potential Risks if Step is Not Done or Done Incorrectly (if any)
Step 1: Don personal protective equipment. ☐ appropriate street clothing (long pants, close-toed shoes) ☐ gloves; indicate type:_____ ☐ safety goggles ☐ safety glasses ☐ face shield ☐ lab coats ☐ other:_____	
Step 2: Check the location/accessibility/certification of the safety equipment that serves your lab including fume hoods, safety showers, spill kits, fire extinguisher, etc.	
Step 3: *Describe the next step in the procedure.*	
Step 4: *Describe the next step in the procedure (add additional steps as needed).*	
Step 5: Dispose of hazardous solvents, solutions, mixtures, and reaction residues as hazardous waste.	
Step 6: Clean up work area and lab equipment. Describe specific cleanup procedures for work areas and lab equipment that must be performed after completion of your process or experiment. For carcinogens and reproductive toxins, designated areas must be immediately wiped down following each use. *[PRECEDING GUIDANCE TEXT MAY BE DELETED]*	
Step 7: Remove PPE and wash hands.	

#7	**EMERGENCY PROCEDURES**

A. Health-Threatening Emergencies (ex: fire, explosion, health-threatening hazardous material spill or release, compressed gas leak, or valve failure)

1. **Call 9-911 (or 286 in the School of Medicine)**.
2. Alert people in the vicinity and activate the local alarm systems.
3. Evacuate the area and go to your Emergency Assembly Point (EAP): Indicate EAP here.
4. Remain nearby to advise emergency responders.
5. Once personal safety is established, call EH&S at 725-9999 (or 286 in the School of Medicine).
6. Provide local notifications: Identify the area management staff that must be contacted and include their work and home numbers. This must include the principal investigator and may

include the lab safety coordinator, facilities manager, and/or business manager. *[PRECEDING GUIDANCE TEXT MAY BE DELETED]*

If personnel exposed or injured:

1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
2. **Call 9-911 (or 286 in the School of Medicine)** if immediate medical attention is required.
3. Call 725-9999 (or 286 in the School of Medicine) to report the exposure to EH&S.
4. Administer first aid as appropriate.
5. Flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes. Remove any contaminated clothing.
6. Bring to the hospital copies of MSDSs for all chemicals the victim was exposed to.

B. Non-Health Threatening Emergencies

For non-health threatening injuries and exposures

Call the Occupational Health Center at 725-5308 for more information and to schedule an appointment.

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or for a spill or release that cannot be cleaned up by local personnel:

1. Notify Stanford University responders by calling 725-9999 (or 286 in the School of Medicine). These services are available 24 hours a day, 7 days a week.
2. Provide local notifications*:* Identify the area management staff that must be contacted and include their work and home numbers. This must include the principal investigator and may include the lab safety coordinator, facilities manager, and/or business manager. *[PRECEDING GUIDANCE TEXT MAY BE DELETED]*

C. Small Spills/Local Cleanup:

In the event of a minor spill or release that can be cleaned up by local personnel using readily available equipment (absorbent, available from EH&S in Small Spill Kit):

1. Notify personnel in the area and restrict access. Eliminate all sources of ignition.
2. Review the MSDS for the spilled material, or use your knowledge of the hazards of the material to determine the appropriate level of protection.
3. Wearing appropriate personal protective equipment, clean up spill. Collect spill cleanup materials in a tightly closed container. Manage spill cleanup debris as hazardous waste.
4. If greater than 30 ml, or if it will take longer than 15 minutes for you to clean up, immediately call EH&S at 725-9999 (or in the School of Medicine, x286) to report the spill, and notify your supervisor.
5. Submit online waste pickup request to EH&S.

D. Building Maintenance Emergencies (e.g., power outages, plumbing leaks):

Call Facilities Operations at 723-2281.

#8	**WASTE DISPOSAL**

N/A

#9	**TRAINING REQUIREMENTS**

General Training *(check all that apply):*

■General Safety & Emergency Preparedness (EHS-4200)

■Chemical Safety for Laboratories (EHS-1900)

□Other:_____

Location Where Records Maintained:	**Nano Bldg, Rm 008**

Laboratory-specific training *(check all that apply):*

□ Review of MSDS for other chemicals involved in process/experiment

■ Review of this SOP

■Other: Agilent 4294A Precision Impedance Analyzer Operation Manual
Agilent Impedance Measurement Handbook

Location Where Records Maintained:	**Nano Bldg, Rm 008**

#10	**PRIOR APPROVALS**