NUS National University of Singapore	**Department of Physics National University of Singapore**	**Ref. No**	*SOP/001*
Standard Operation Procedure		**Rev. No**	*003*
Title: Model 6000 physical property measurement system		**Pages:**	5
Lab: Nanomaterials & Devices Group			

Written by	Approved by	Issue date	Review date
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1. Purpose

The objective of this SOP is to provide guidelines to all the laboratory personnel on operating model 6000 physical property measurement system.

2. Scope

The procedure is applicable to all research staff, research students and technical staff working in the laboratory.

3. Responsibility

It is the responsibility of the PI in conjunction with the laboratory I/C to ensure that all research and technical staff and students are advised, prepared and trained.

3.1. Principal Investigator

The principal investigator is responsible for the implementation of these guidelines and takes ownership of all research and technical staff, graduate and undergraduate students under his charge in ensuring that they will carry out their activities in a reasonably practicable manner. The PI has to ensure that all the personnel mentioned above are adequately advised, prepared and trained.

3.2. Staff / Students

All research and technical staff and graduate students are under the obligation to work and behave safely and are responsible for taking care of their own health and safety and not placing themselves or others at risk of injury

4. Personal protective equipment

At a minimum, chemically resistant gloves, long-sleeve lab coat, chemical-spill-proof goggles with side shield and closed toed shoes should be worn. This is to be considered as minimum protection and must be upgraded if necessary.

5. Safety precautions

Inspect equipment to be used and ensure all are in proper working condition. Report any equipment deficiencies prior to use.

6. Procedure

6.1. Sample loading

- Mount the sample/device on the sample chip carrier.

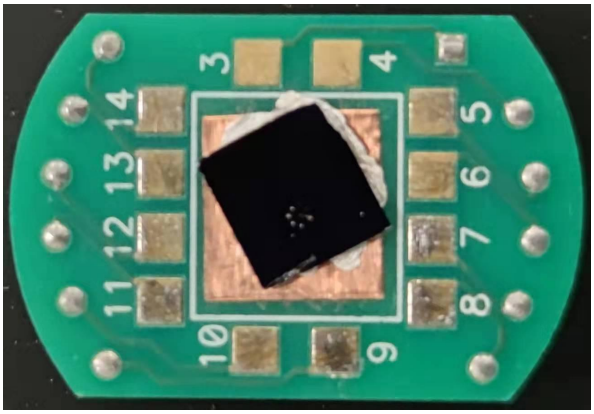


Figure 1. A device mounted on the chip carrier

- Connect the device pads to the chip carrier using wire bonder or silver paste.
- Ground all the connected pins on the connector box. Mount the chip carrier to sample holder.

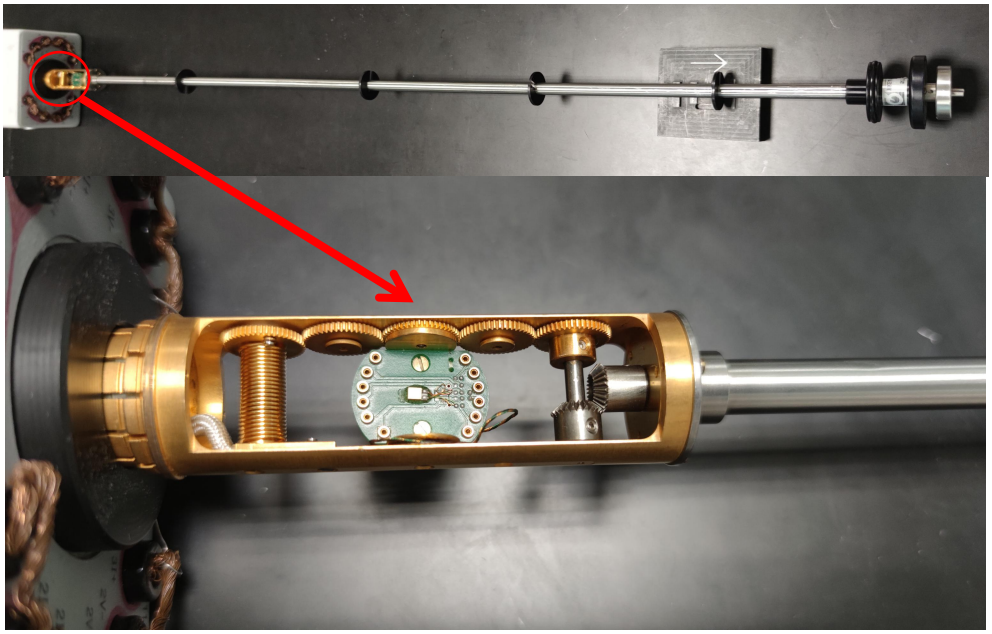
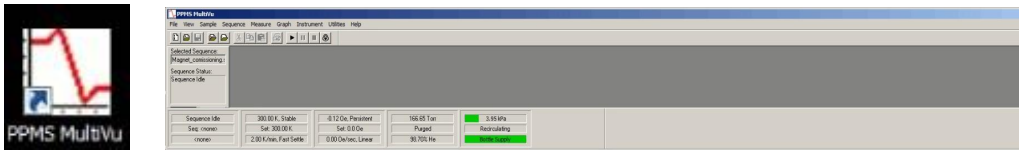


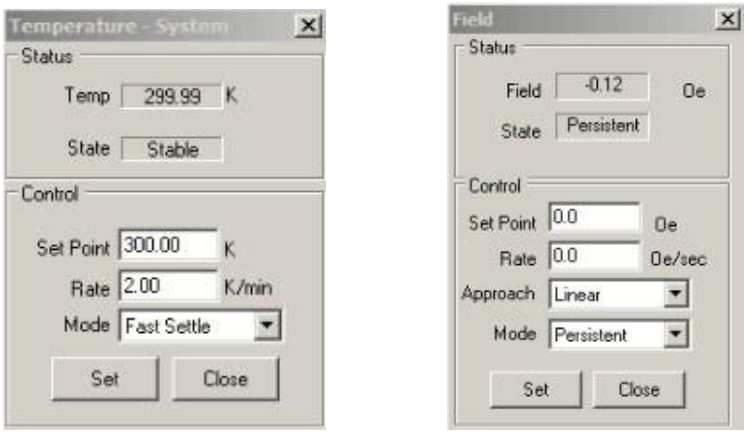
Figure 2. Sample holder

- Using MultiVu software of PPMS controller set the temperature inside PPMS to 300K and magnetic field to 0T.



(a) (b)

Figure 3. (a) Shortcut pattern of MultiVu Software. (b) Interface of MultiVu.



(a) (b)

Figure 4. (a) Interface of temperature control. (b) Interface of magnetic field control

- Vent the chamber continuously. Carefully insert the sample holder inside the chamber. Avoid the bending of the sample holder leg.
- Purge and seal the chamber with MultiVu software.

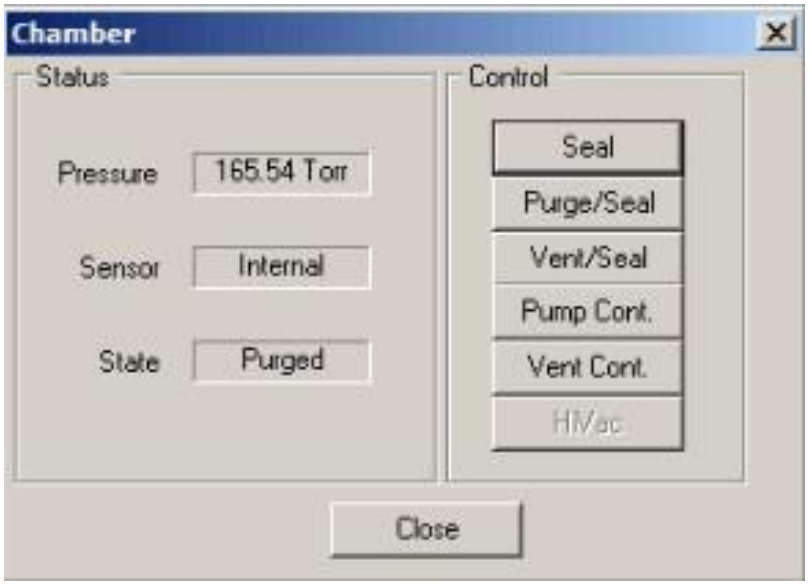


Figure 5. Interface of chamber control in MultiVu software

6.2. Sample unloading

- Set the temperature inside PPMS to 300K using temperature controller. Make sure magnetic field is zero. Keep the temperature of the chamber at 300K for 2-3 hours before proceeding to the next step.
- Continuously vent the chamber.
- Carefully take the sample holder out of the chamber. Avoid the bending of the sample holder leg.
- Insert the cap to the chamber, then purge and seal it.
- Unmount the chip carrier from sample holder.
  Do not insert the sample holder with water drops condensated on the leg. Carefully wipe the leg with clean tissue and leave warming up till it reaches the room temperature.

7. Safety precaution

- **High voltage.** While handling the PPMS sample holder or wiring the connector box do wear protective latex gloves on your hands. Don't touch open wires with wet hands. They rust from that.
- **Strong magnetic field.** Keep your hand phone, credit card and heavy magnetic items away while applying high magnetic field.
- **Low temperature.** Do not open the chamber when it is at low temperature. Water will condensate on the sample holder and may hurt your skin.

8. Operation control

8.1. Administrative control

- The machine is fully labelled with safety precaution
- The machine loading cannot be opened without sufficient training

8.2. Engineering control

- The working place is chained for unexpected entry prevention
  The equipment is fully sealed and test is run inside

9. Revision History

Date Revised	Revision No.	Author	Revision Summary
20.12.2018	001	Ivan Verzhbitskiy	Operation procedures
27.12.2021	002	Chen Mingjun	Formats
29.12.2021	003	Sun Xingjian	Details updating