

University of Minnesota Nano Fabrication Center

Standard Operating Procedure

Badger Name: P5 Nanoimprinter B200 Nanonex

Model: NX-B200
Location: Bay 4

Revision Number: 3
Revisionist: Kevin Roberts
Date: 03/12/2020

1 Description

Nanonex NX-B200 nanoimprinter is another method of transfer a pattern to a wafer with good resolution. This nanoimprinter is designed for thermal and photo-curable nanoimprint lithography (NIL). For more information see <http://www.nanonex.com/>.

2 Safety

a

3 Restrictions/Requirements

a No samples greater 75mm in diameter.

b

4 Required Facilities

a 120 V/30A

b Nitrogen

c Compressed Air

d Vacuum pump exhaust

5 Definitions

a Nanoimprint lithography (NIL)

6 Setup

a None

7 Specifications

a Maximum pressure 500 psi

b Maximum temperature 250 C

c Imprint resist – Thermal resist -NX-1025, Two part UV resist –NX-3022 and NX-2010

d Maximum substrate and mold size 75mm.

8 Operating Instructions

a Log in to Badger

b Turn on the key switch.

c Open drawer

d Remove top film holder

e Remove wafers.

f Place the smaller diameter thin film (bottom) on the wafer holder. Make sure the film covers the large inner hole and extends to the edge of the eight small holes as shown in figure 4-4. The film must be flat with no wrinkles or cuts, replace film if film is defective.

g Place the mask (mold) and wafer (substrate) in the center of the wafer holder, see figure 4-5

h Place the larger diameter thin film on the Top Film Ring Holder. The film is held in place by eight magnets, located as shown in Fig 4-6. The magnets must be placed over the pins on the bottom side of the top film holder (see figure 4-6). Again the film needs to be flat with no wrinkles or cuts, replace if the film is defective

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- i Place the Top Film Ring Holder onto the wafer holder, see figure 4-7. Align the cut out notches on the holder with the guide pins on the wafer chuck, see figure 4-8. The magnet side of the holder faces down, you should be able to read **“This side up”** (see figure 4-8), if you do not, **STOP**. Change the top film holder to make it correct.
- j Gently push the drawer into the chamber until there is an audible “click”.

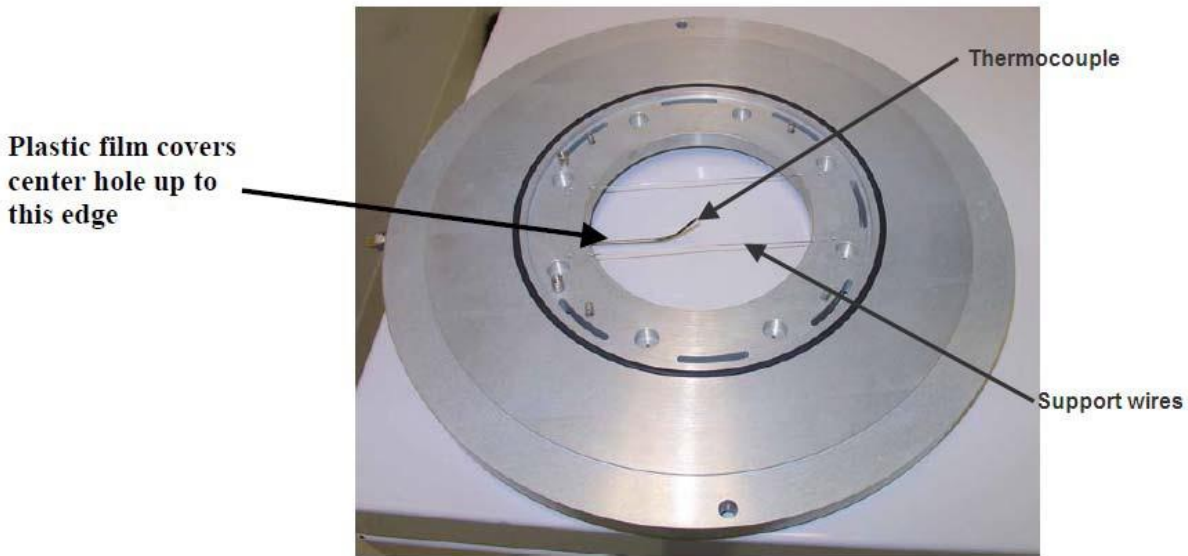


Figure 4-4 A small plastic thin film is placed on the wafer holder.

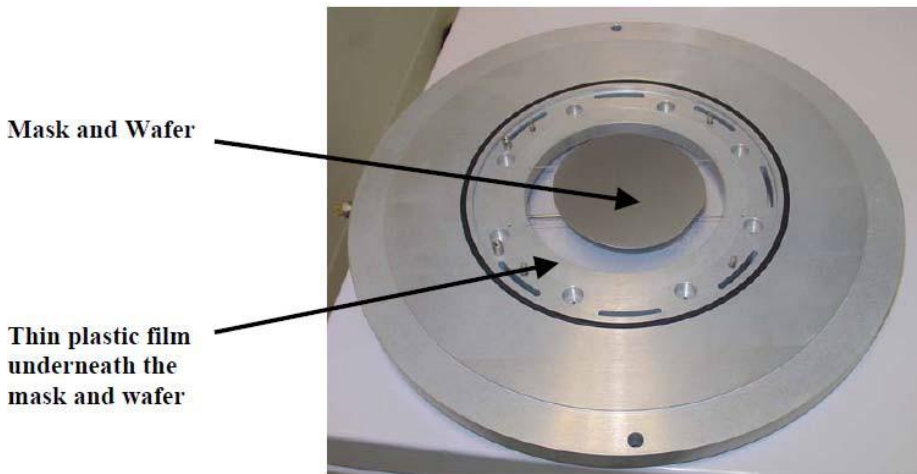


Figure 4-5 Mask and wafer are placed on the wafer holder

- k When placing your mask (mold) and wafer (substrate) on the center of the bottom film, be sure to cover the thermocouple with your mask (mold) and wafer (substrate) to get better temperature control. See figure 4-4. If pieces are used the support wires will need to keep the mold and substrate in place (see figure 4-4).

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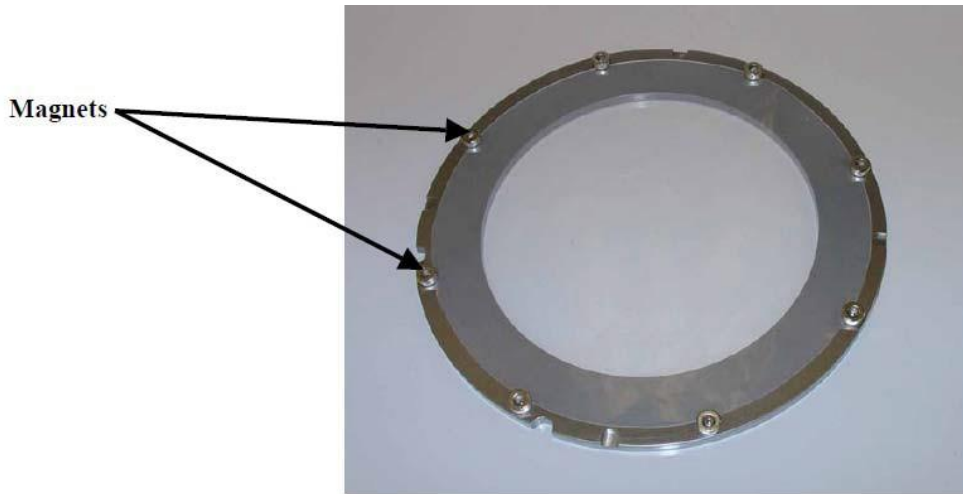


Figure 4-6 The larger diameter thin film is placed on the Top Film Ring Holder.

- 1 **To replace the top film**, remove all magnets from the top film ring holder, place them on a wipe separated by a large distance, so that the magnets will not stick together. Remove a top film from the package label new top film on top of the machine, put the old film in a package marked old top film. Put the new film equal distance from all the posts; replace the all magnets, making sure that the film is flat.

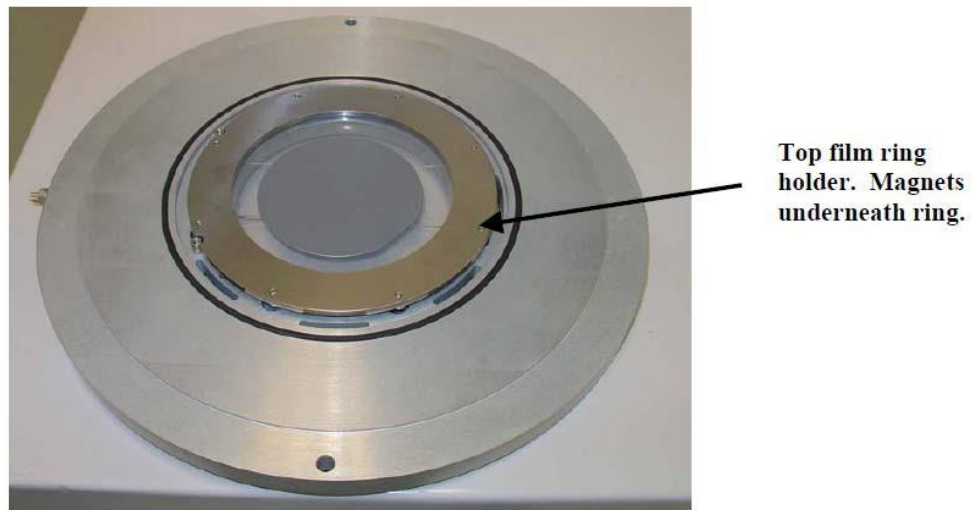


Figure 4-7 A larger diameter thin film is placed on the wafer holder.

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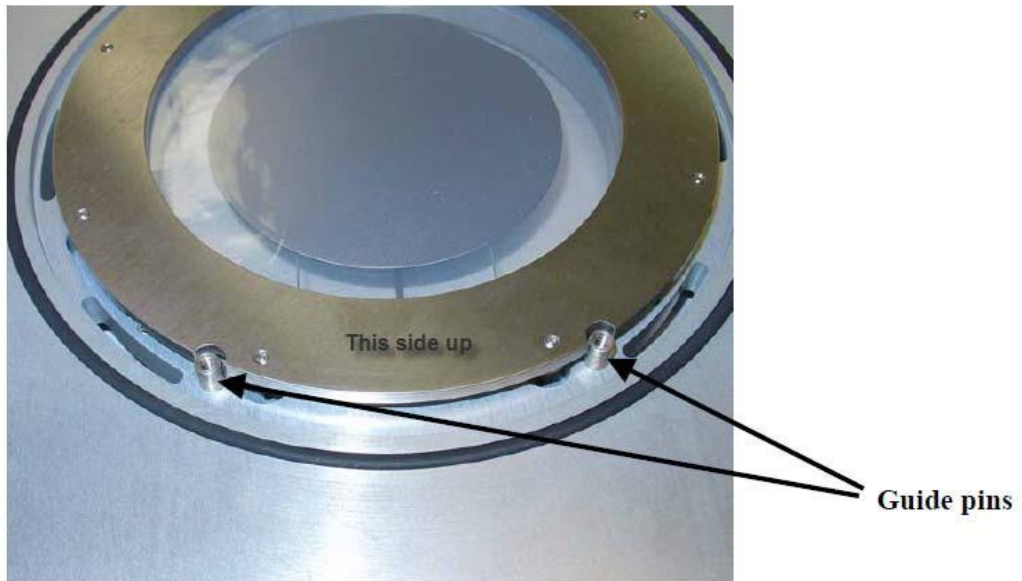


Figure 4-8 A larger diameter thin film is placed on the wafer holder.

- m When positioning the top film holder on the guides pins make sure that you can read “THIS SIDE UP”, if you place the top film in the drawer upside down, major damage can occur with the machine.

n

9 Imprinting

- a Log on to the computer using user ID **user** and password **user_1234**.
- b Open control program by double clicking on the *NX- B200 v3.7 all_users* icon on computer desktop.
- c Click “Users” ⇒ “Log in” (“a” in figure 4-9), enter user ID- **user** and Password – **user_1234**, and click “OK” to log onto the system. If for some reason, you don’t want to log in, just click “EXIT” in the log in pop up menu. The program will terminate.

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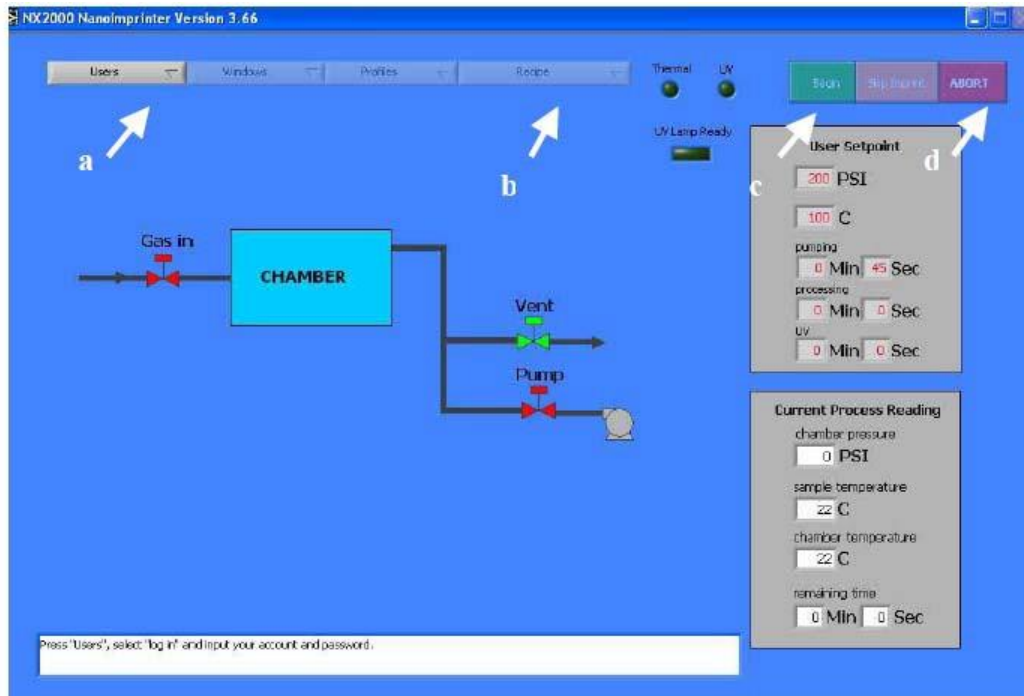


Figure 4-9 NX-B200 v3.65 menu

- d Click load recipe (“b” in figure 4-9)
- e Open File
- f Go to folder NX-B200 recipes.
- g Load a basic recipe- highlight a recipe, click open (Process parameters load fixed window will open)
- h Modify the recipe if needed and save in your directory.
- i Click OK.
- j To begin imprint click green “Begin” button (“c” in figure 4-9).
- k Click “OK” button in the pop-up menu (figure 4-11), the chamber closes automatically and the vacuum pump starts to pump the chamber. **WARNING!!!** From this point on DO NOT pull out the drawer until the program is finished and the chamber has stopped moving. When user-set pumping time expires, the imprinting process begins automatically. During the process, temperature and pressure inside the chamber are monitored in real-time and displayed on the monitor (figure 4-12).

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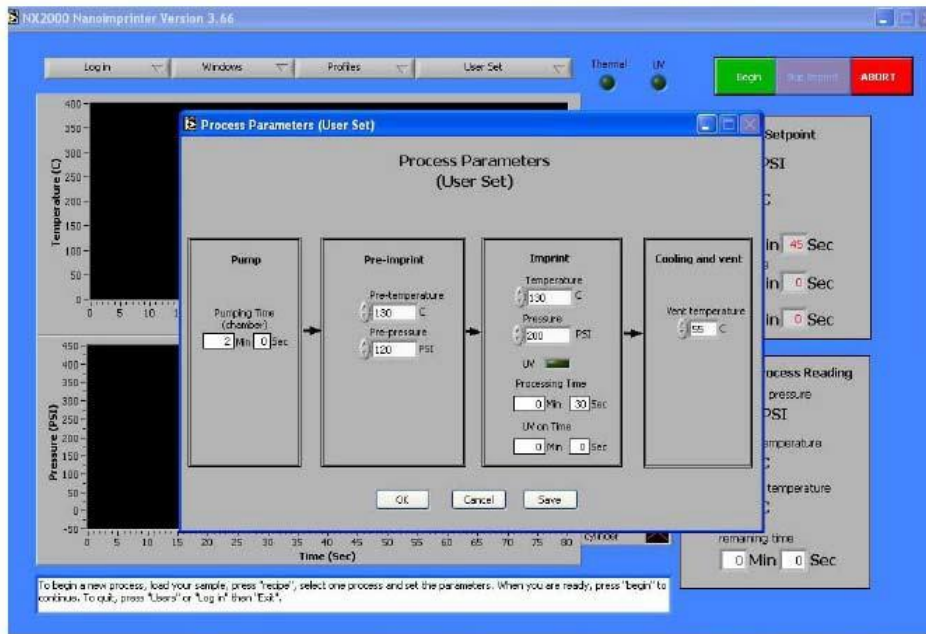


Figure 4-10 Imprinting parameter menu

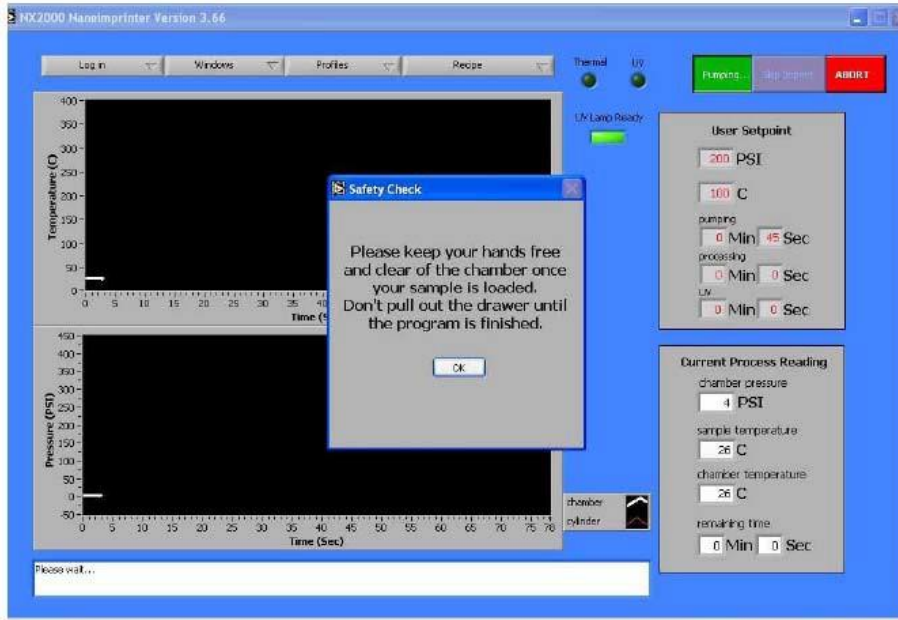


Figure 4-11 Pop-up confirmation menu

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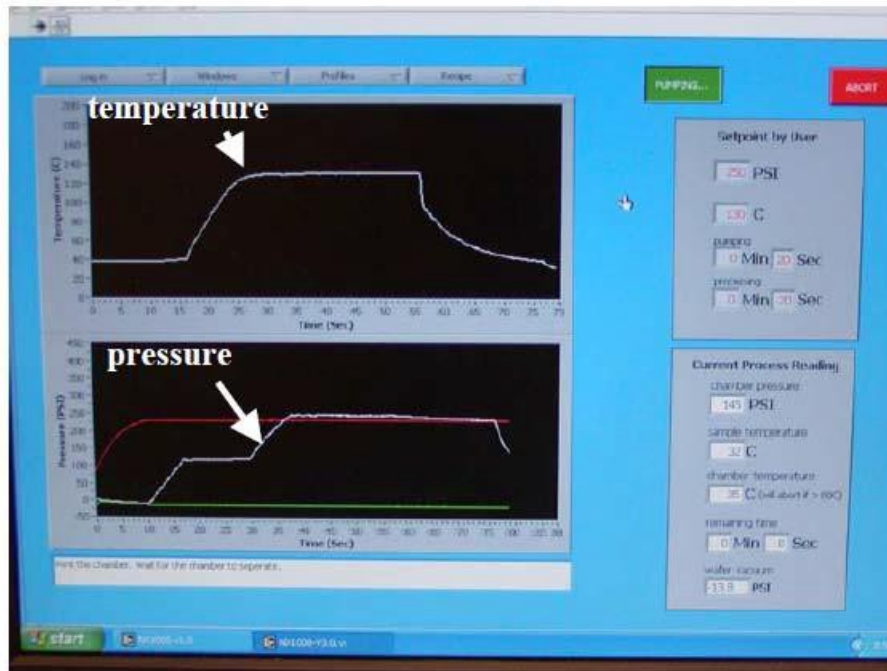


Figure 4-12 Real-time monitoring of temperature and pressure during imprinting.

- l When imprinting is finished, the chamber vents and opens automatically. The status indicator at the bottom of the screen shows “To begin a new run”. The operator can open the drawer and remove the sample at this time. **Warning!!** Use Caution before handling Top Film Holder maybe hot after high temperature imprint, allow the holder to cool before handling.
- m Repeat Step j through l for next imprint run.
- n After finishing all imprint runs, click “**Login**” ⇒ “**Exit**” to exit the program.
- o During imprint, you can click the “**skip imprint**” button (“a” in figure 4-13) to skip current imprint and directly go to cooling of sample.
- p At any time the operator can abort the process by clicking the red “abort” (“d” in figure 4-9) in the upper right of the screen. After pressing the abort button in the software, the operator should wait for ~ 1 minute, and then follow the screen instructions to continue. Also, an emergency stop may be executed by pressing the red Emergency button on the small box underneath the monitor. After an emergency stop, the operator must contact NFC staff to reset the machine.

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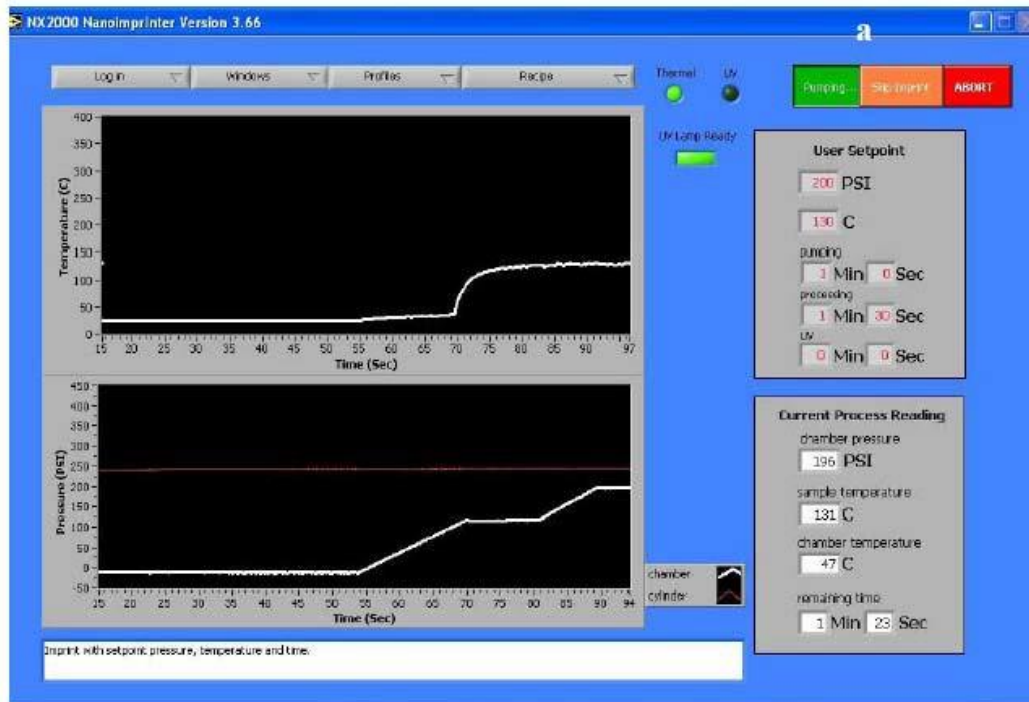


Figure 4-13 Skip imprint button activated during imprint

- q Shut Down.
- r Switch control key to “OFF” position.
- s Exit the NX-B200 software.
- t Log off the system.
- u

10 Removing your mold from your wafer

- a Place your mold and substrate on a wipe, mold up.
- b Working from the flat or an edge, separate the mold and substrate with a razor blade and force an air jet between the two surfaces. This may need to be done for a few locations on the mold. Do not damage the mold with the razor blade.
- c Cleaning the NXR-1025 resist off the mold- use acetone and IPA spray the surface thoroughly with each, then blow dry.
- d

11 Pattern Transfer

- a Using the STS etcher and the STS etcher and program O2NIL50W etch the residual layer. Etch rate ~800 A/min for NXR-1025
- b Transfer your pattern using the correct etch program for your process

12 Making a Mold

- a Using either the Raith e-beam writer to write a 3” diameter or less, or the Cannon stepper to create a 4” wafer and cut it down to 3” diameter or use standard lithography to create a mold.
- b Apply a release layer to the mold.