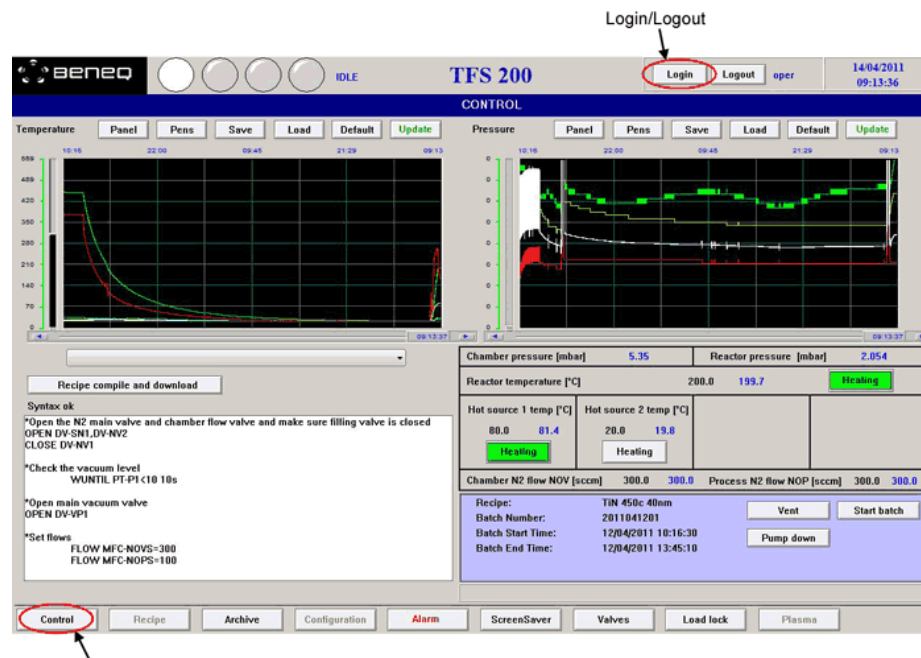


HOW TO USE THE SYSTEM (1)

I. Login / logout

1. Login on the PC zone 4
2. Click on "Control" tab to open the window "Control" on the Beneq laptop
3. Click on Login:
Enter : **oper** and press return
4. Click on Password :
Enter : **oper** and press return



Once all your depositions are finished, the equipment come back in idle mode:

1. Switch off the heating if you are the last user
2. Fill the notebook
3. Log out on the PC zone 4

HOW TO USE THE SYSTEM (2)

II. Setting of the reactor and precursors temperatures

On the control window, you click on the black number corresponding to the reactor temperature and to the precursor temperature and you enter the temperature requested for the deposition (see below). It takes roughly 30 min for the reactor to get 200°C from room temperature and 1 hour for the hot sources.

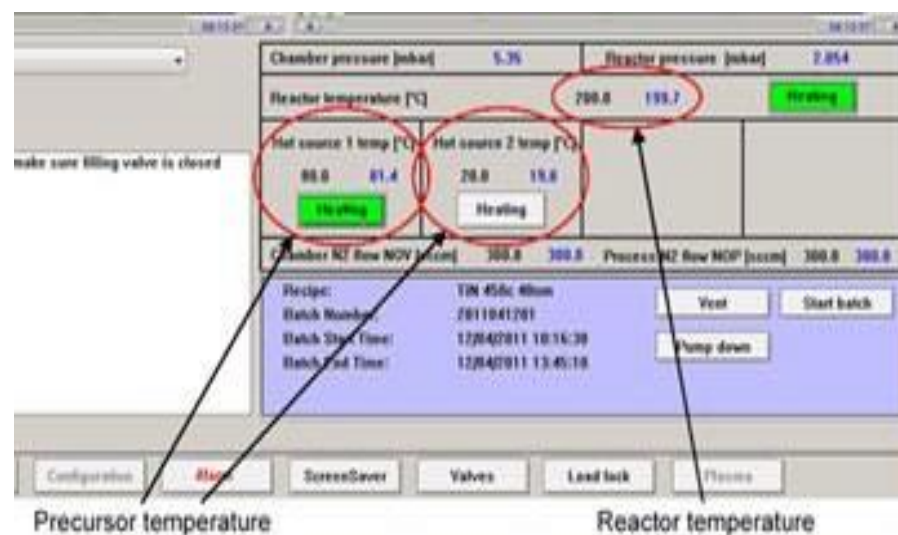
Al₂O₃ : Chamber: 200°C
Liquid precursor 2 (TMA): room temperature

TiO₂ : Chamber: 180°C
Liquid precursor 3 (TiCl₄): room temperature

HfO₂ : Chamber: 200°C
Hot source 1 (TEMAHf): 80°C

SiO₂ : Chamber: 300°C
Liquid precursor 4 (BTBAS): room temperature

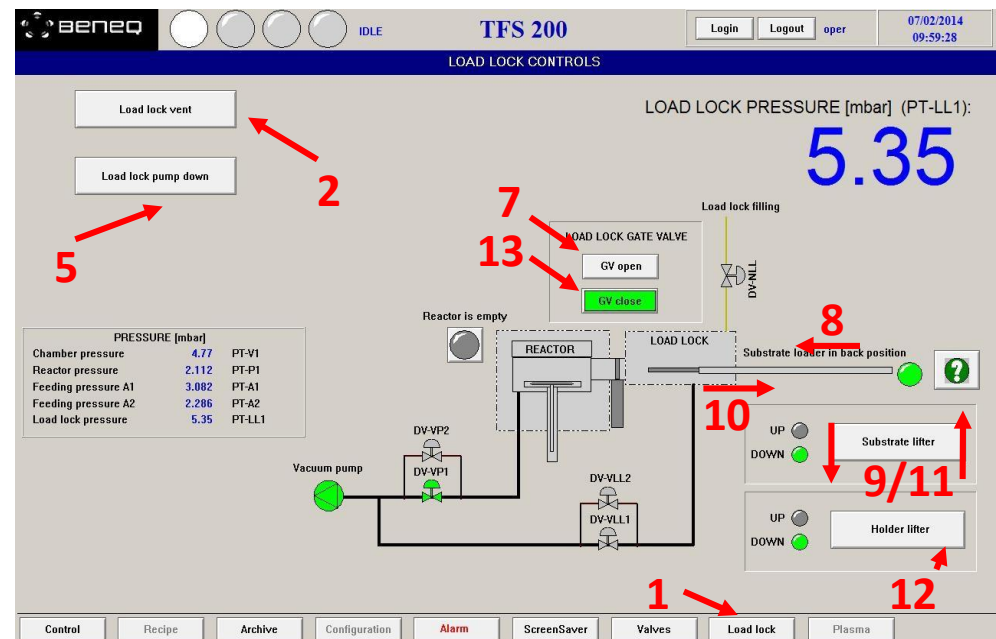
Pt : Chamber: 280°C
Hot source 2 (CpMePtMe): 75°C



HOW TO USE THE SYSTEM (3)

III. Wafer loading

1. Press on the load lock button (bottom right)
2. Press on load-lock vent and wait until the load lock is at atmospheric pressure
3. Open the load-lock door
4. Load your wafers / samples
5. Close the load-lock door and press on load-lock pump down
6. Checking of the wafer position
7. Open gate valve
8. Manual transfer of the wafers in the reactor with the substrate loader
9. Move up the substrate lifter
10. Move back the substrate loader in the Home position
11. Move down the substrate lifter
12. Move up the holder lifter
13. Close the gate valve



HOW TO USE THE SYSTEM (4)

IV. Starting a recipe

Before starting the recipe, the chamber pressure has to be higher than 4 mbar and the reactor pressure lower than 2 mbar for NOV and NOP at 300 sccm and reactor temperature around 200C. If it's not the case move down and up the substrate lifter or restart the loading procedure.

1. Go to the window Control
2. Select your recipe in the recipe folder
3. Press compile and download the recipe
4. Press start batch and follow the instructions (open precursor valves)

The screenshot displays the control interface with several key elements highlighted:

- Recipe folder:** A red oval highlights the 'Recipe compile and download' button in the top left.
- Start recipe:** A red oval highlights the 'Start batch' button in the bottom right.

The interface shows the following data and controls:

Chamber pressure [mbar]	5.35	Reactor pressure [mbar]	2.854		
Reactor temperature [°C]	200.0	199.7	Heating		
Hot source 1 temp [°C]	80.0	81.4	No heating		
Hot source 2 temp [°C]	70.0	19.0	Heating		
Chamber N2 flow NOV [sccm]	300.0	300.0	Process N2 flow MOP [sccm]	300.0	300.0

Recipe details:

- Recipe: TIN 450c 45nm
- Batch Number: 2011041201
- Batch Start Time: 12/04/2011 18:16:38
- Batch End Time: 12/04/2011 13:45:18

Buttons: Vent, Start batch, Pump down

Bottom navigation: Control, Recipe, Archive, Configuration, Alarm, ScreenSaver, Valves, Lead lock, Process

HOW TO USE THE SYSTEM (5)

5. As soon as the recipe starts, a “Loop counter” button will appear on the bottom right. Click on it, and set the desired pulse number in the window that opens, by clicking under the “Set” Label, entering the number of pulses, and pressing the enter key on the keyboard.

The screenshot displays the BENEQ TFS 200 control interface. At the top, there are status indicators (RUN, TFS 200) and user information (Login, Logout, beneq, 08/03/2023, 08:37:36). The main area is divided into several sections:

- Temperature and Pressure Graphs:** Two large graphs showing real-time data. The left graph shows temperature (0 to 1000) and the right graph shows pressure (0 to 24).
- Recipe Execution Panel:** A central panel displaying current process parameters:
 - Chamber pressure [mbar]: 8.68
 - Reactor pressure [mbar]: 1.577
 - Reactor temperature [°C]: 200.0 (set), 201.3 (actual), with a green "Heating" indicator.
 - Hot source 1 temp [°C]: 10.0 (set), 42.0 (actual)
 - Hot source 2 temp [°C]: 10.0 (set), 44.7 (actual)
 - Chamber N2 flow NOV [sccm]: 450.0 (set), 450.0 (actual)
- Recipe Details:** A text area on the left showing the recipe steps:

```
*Start TMA line purge
WRITE M25
WUSER YES
PULSE DV-PL2 2min
*end program
EPROG
```
- Control Panel:** A bottom row of buttons including Control, Recipe, Archive, Configuration, Alarm, ScreenSaver, Valves, Load lock, and Plasma.

A "Loop counter" dialog box is open, showing a list of levels (Level 1 to Level 5) and a "Set" field where the value 500 is entered. The "Actual" field shows 4. A red circle highlights the "Loop counter" button in the bottom right corner of the interface.

6. At the end of the process close the hand valve if requested

HOW TO USE THE SYSTEM (6)

Valves setting during deposition

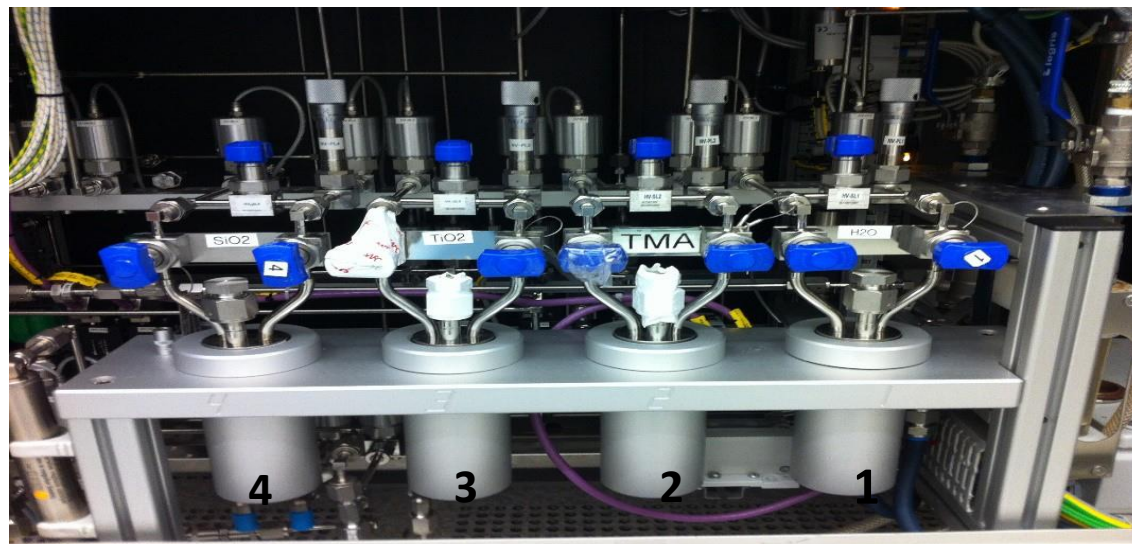
Al₂O₃ : Open the hand valves (right ones) of liquid precursor 1 (H₂O) & liquid precursor 2 (TMA)

HfO₂ : Open the hand valve (right ones) of liquid precursor 1 (H₂O) / Hot source 1 already open (TEMAH)

TiO₂ : Open the hand valves (right ones) of liquid precursor 1 (H₂O) & liquid precursor 3 (TiCl₄)

SiO₂ : Open the hand valves (right & left) of liquid precursor 4 (BTBAS) / Gas precursor (O₃) already open

Pt : Hot source 2 is already open (CpMePtMe) / gas precursor (O₂) is already open



HOW TO USE THE SYSTEM (7)

V. Wafer unloading

1. Go the window Load lock
2. Open the gate valve
3. Move down the holder lifter
4. Move up the substrate lifter
5. Transfer of the substrate loader in the reactor
6. Move down the substrate lifter
7. Move back the substrate loader in home position
8. Close the gate valve
9. load-lock vent / wafer unloading
10. Open the load-lock door and take your wafers
11. Close the load-lock door and then clic on load-lock pump down
- 12. Wait for the message "Load-lock Vacuumized, Close load-lock lid, Press yes to continue" and press "Yes"**
- 13. Wait for the message "Load-lock Vacuumized, Gate valve can be opened, Press yes to continue" and press "Yes".**