University of Minnesota Nano Fabrication Center
Standard Operating Procedure

Equipment Name: Trion II RIE (chlorine gases)

Coral Name:	trion2	**Revision Number:**	1
Model:	Trion	**Revisionist**:	K. Roberts
Location:	Bay 3	**Date:**	3/29/05

1 Description

This reactive ion etcher has a load-locked chamber and is used for chlorine-based etching. The system currently has three chlorine gases available: Cl_2, BCl_3, and $SiCl_4$. The system has a four inch wafer platen which can accommodate whole wafers or pieces on whole wafers.

2 Safety

a As the system uses chlorine gas, be sensitive to any such smells. The system should emit **no** chlorine odor whatsoever. If you smell a chlorine odor, put system in STANDBY mode and contact MTL staff immediately.

3 Restrictions/Requirements

a Must be a qualified user on the Trion II.

4 Required Facilities

a Compressed air
b Nitrogen
c Chilled water
d Oxygen
e Chlorine
f $SiCl_4$
g CF_4
h BCl_3
i Argon

5 Definitions

6 Operating Instructions

a LOGGING ON
  1 Enable "trion2" on CORAL.
  2 Fill out user info in log book.

b SETUP PROCEDURE

1 The RIE should be left in the Standby Mode when it is not in use. If it is not in Standby Mode, select Standby. Once in Standby Mode, press CANCEL, which will take it out of Standby Mode and bring up the Main Menu.
2 From the Main Menu, select the FILES button on the display. Enter the password 1225. This screen will show you which files are available from the hard drive. Select the file you want and press EXIT. The screen will again show the Main Menu. At the bottom of the screen there is a box confirming the file you have chosen.
3 Select MANUAL MODE and check over each program step to see if it is the process you want. You may alter the parameters in this mode for your run. They will be carried out in the AUTO MODE, but will not be saved. To save a recipe change permanently, contact NFC Trion II process staff.

c SAMPLE LOADING

1 Place your 100 mm wafer sample in the left chamber on the robot arm. If using a smaller sample, place this on a 100 mm carrier wafer. The wafer should be aligned such that one of its round edges mates with the round crescent at the base of the fork which comprises the robot arm.
2 Close the cover.
3 Excercise the lift pins in the Reaction Chamber by using the UP and DOWN buttons in the lower left side of the screen. Usually three cycles should be sufficient. This is only necessary prior to the first loading of a wafer after a period of disuse. If not performed, the pins may not be fast enough to remove the wafer before the robot arm leaves the reaction chamber.

Tip: If you forget to excercise the lift pins and/or the sample is brought back out on the robot arm, simply remove the sample and proceed as if to remove an imaginary wafer from the Reaction Chamber. This will get the sytem back into the correct state with regards to the 'LOAD' and 'UNLOAD' buttons displayed.

WARNING:

DO NOT PRESS **ABORT** DURING A 'LOAD' OR 'UNLOAD' SEQUENCE UNLESS A REAL EMERGENCY ARISES. ONCE ABORTED, THE SYSTEM GOES INTO A FROZEN STATE AND CANNOT BE RE-STARTED BY ANYONE OTHER THAN MAINTENANCE PERSONNEL WITH THE CORRECT PASSWORD.

4 Press the LOAD WAFER button. The LOAD WAFER routine will only be performed if you have just left the Standby Mode. If, for instance, you have just performed an oxygen plasma clean, you will be instructed to return the system to Standy Mode before continuing. If this is necessary, select STANDBY; once the system is in Standby Mode, press CANCEL to return to

the main menu and perform the load sequence. This is to ensure the sytem is in the proper state with regard to pressures, pumps, and valves before opening the gate vlave to the Reaction Chamber.

d OPERATING PROCEDURE

1 Press the AUTOMATIC PROCESS CONTROL icon. Allow recipe to run as long as needed. The etch time will be dictated by the time as defined in the process, or by pressing the ABORT icon.

e SAMPLE UNLOADING

1 Press the UNLOAD WAFER button. The system will automatically cycle purge the reaction chamber 5 times before unloading the wafer. Remove wafer from the Load Lock chamber when vented.

WARNING:

DO NOT PRESS **ABORT** DURING A 'LOAD' OR 'UNLOAD' SEQUENCE UNLESS A REAL EMERGENCY ARISES. ONCE ABORTED, THE SYSTEM GOES INTO A FROZEN STATE AND CANNOT BE RE-STARTED BY ANYONE OTHER THAN MAINTENANCE PERSONNEL WITH THE CORRECT PASSWORD.

f LOGGING OFF

1 Put system in Standby Mode.
2 Fill out any remaining info in log book.
3 Disable "trion2" on CORAL.

7 Problems/Troubleshooting

8 Appendix

Aluminum RIE Process for the Trion II

1. O_2 clean the chamber **15 minutes** (no need for dummy wafer during O_2 cleans)

   300 mTorr
   50 sccm 02
   100 Watts

2. Transfer wafer to etch chamber (will automatically perform Ar purge).

8 Appendix [cont.]

Aluminum RIE Process for the Trion II [cont.]

3. Aluminum oxide breakthrough **60 seconds (or less)**

   15 sccm Cl2
   30 sccm BC13
   200 mTorr
   25 watts

4. Aluminum etch, **continue 10% beyond clear. Press Abort to stop.**

   8 sccm C12
   30 sccm BC13
   30 mTorr
   25 watts

5. Unload. Will automatically Ar purge chamber.

6. After unloading the wafer, rinse for ***at least* 1 minute** in DI water. **This will inhibit corrosion from occurring.**

   NOTES:

   The etch rate is approximately 600 to 800 A/minute.

   There might be a change in the plasma color from green to light sky blue when the aluminum oxide is broken through.

   Perform the standard photolithography process as the Al masking layer.