How (and Why) To Use The Residual Gas Analyzer

Warning!

The pressure in the chamber should not exceed ~ $2x10^{-5}$ Torr, in order to protect the white-hot filament in the RGA. Thus, when you are going to open the Needle Valve to bleed some air into the vacuum system, TURN OFF THE FILAMENT BEFORE YOU OPEN THE NEEDLE VALVE. Once the pressure is ≤ $2x10^{-5}$ Torr, you can turn the filament back on.

Notes about RGA Program:

- RGA program icon appears on the desktop. Turn on the power to the RGA (switch on the power strip and switch on top of the RGA – green "power" LED should be on).
- Once the program is open, you must first connect to the RS232 port.
- Once connected, you're ready to take measurements after the filament is turned. **But do not turn on the filament until pressure in the chamber is ≤ $2x10^{-5}$ Torr!**
- Scans can be saved to the hard drive or to disk.
- You can also send the scans to the printer, but it is a good idea to change the Y-axis labels from yellow to black if you are using the color printer.
- The RGA measures charge-to-mass ratios, and a "X_2" diatomic molecule of atomic mass M can appear at masses of 2M (X_2^+), M (X_2^{++}) and M (X^+). The residual gasses are ionized by electron bombardment, so the X^+ state could be due to the electron beam "cracking" the molecule. A library of cracking distributions of various molecules is provided in the program.

Start – Up: What is the mass distribution of the gas left in the chamber?

- Both the Mechanical and Diffusion Pumps should be running, with a low base pressure (~10^{-6} Torr).
- Once this pressure is reached, turn on the RGA filament and do an analog scan to see what this mass distribution is. Try to establish what molecules are present.

Things to Try:

- **Turn off the filament!**
- Using the Needle valve, bleed in enough air until you reach a steady pressure on the order of $2x10^{-5}$ Torr. After ~ 2 full CCW turns, you will feel resistance. Another ~ ½ CCW turn should open the needle valve, and the pressure will shoot up so much that the Penning gauge will turn off. Start closing the needle valve until you have ~ $2x10^{-5}$ Torr. Turn on filament.
- Do a scan (analog) of what's inside the chamber with air bleeding in. What molecules are present and in what abundance? What changed from the first scan you did with the needle valve closed?
- Choose 5 or 6 prevalent molecules from your previous scans, and do a "P vs. t" scan starting with the needle valve open, and then closing the needle valve during the scan (turn the knob clockwise!).
- Try adding liquid nitrogen to the tube and watch what happens to the relative abundance of the molecules. Can you explain what you see?
- Try doing (P vs. t) scans of a suitable set of molecules while you let various pure gases into the chamber through the partially-open needle valve.
- Try inserting a Q-tip dipped in Acetone and/or Ethanol into the needle valve. Can you detect either of those solvents with the RGA? Are the molecules "cracked"?
- Try running different kinds of scans listed in the "mode" menu.