AIT Measurement Standard Operating Procedure

Last modified on: May 29, 2018 by Mark Redd

- **NOTICE: Lab policy requires that any person performing AIT measurements must have done the following before performing any experimental work:**

  - **Complete pertinent laboratory safety training**
  - **Read this SOP in its entirety**
  - **Become familiar with all the experimental steps outlined in this SOP**
  - **Sign and Date the AIT SOP Signatures Sheet**

Contents

1 Experimental Setup and Maintenance

1.1 Flask and Lid

- **Latex or nitrile gloves and safety glasses are required while working with the flask/lid assembly**

- The flask in the furnace must be exchanged for a clean flask in the following situations:

  - The next experiment will be for a different compound
  - The next experiment will be for a new container of the same compound
  - There is reason to suspect that the flask has become contaminated or substantially dirty
  - The flask has been used for 10 runs without being cleaned
  - Once the AIT has been found for a compound, the final measurements should be repeated with a clean flask to verify the results

- Disassembling the Flask and Lid

  - **The furnace may be too hot to open for several hours after an experiment**
  - Unplug the thermocouples from the furnace
  - Once the furnace is cool, remove flask/lid assembly
    * Loosen (do NOT remove) the nut that secures the bracket and the rubber hose to the top of the furnace with a wrench
    * Move the bracket out of the way and remove Thermocouple 4 (along with the rubber hose) from the top of the furnace
    * Move the mirror out of the way to allow the flask/lid assembly to come out
    * Grip the assembly with both hands by the screws on top and pull directly upward
    * **NOTE: The flask/lid assembly is heavy and pulling it out can be awkward. Please ask someone to help you remove it if you are at all unsure about removing the assembly**
    * The flask/lid assembly should easily come out of the furnace without catching on anything
  - **Carefully** set the assembly on a table or other stable surface with the flask on top (See Figure 2)
  - Ensure the bracket screw is loose
  - Remove the circular spring from its groove and slide the ceramic halves of the lid apart sufficiently to allow the flask to be removed
  - Remove flask from lid assembly and remove all of the aluminum foil and thermocouples from the flask
  - Discard the used aluminum foil in a normal trash can and set aside the thermocouples in the hood or on a surface where they will not catch on anything or become damaged
  - **Always store bulb flasks on the drying rack above the sink or appropriately secured to a ring stand** (see "Flask Cleaning" below)

- Assembling the Flask and Lid

  – Use the figures in this section as a reference when putting together the assembly

  – Use a **clean**, 500 ml, round bottom, long neck, bulb flask (PYREX$^{©}$ 500mL Long Neck Boiling Flask, Round Bottom, Tooled Mouth, Product No.: 4280-500 from Corning Inc.)

  – If dirty, wash out the flask using soap and water and dry as much as possible (see "Flask Cleaning" below); be sure to rinse thoroughly

    * Any leftover water will boil away when the furnace heats up and before any measurements are taken

  – Wrap entire flask in aluminum foil with thermocouples at the bottom, side and top of the round part of the flask (thermocouples should be touching the glass directly) (Refer to Figure 1)

    * NOTE: The more reflective side of the foil should always be facing inward

    * Start by getting a long strip of aluminum foil (12" long or so)

    * Use a utility knife to poke a hole near the middle of the foil and insert thermocouple 3 through the foil so the bead sits at the bottom of the flask and then wrap the foil around the bottom (1 and 2)

    * Slide thermocouple 2 down to the approximate middle/equator of the flask between the flask and foil and use a second piece of foil to wrap further up the flask, ensuring the thermocouple wires run parallel up the side of the flask (3)

    * Place thermocouple 1 at the top of the bulb of the flask (not on the neck of the flask) and use a third piece of foil to wrap around the top starting at the middle (4)

    * Add an additional layer of foil around the flask so the wires are covered and run parallel when wrapping is finished (5)

    * Wrap additional foil around the neck of the flask to cover it completely and secure flask in lid assembly

    * The thermocouple wires should emerge from the foil covering near the top (but not at the top) of the flask neck, allowing them to run between the two ceramic halves of the lid assembly (6)

Figure 1: Steps for wrapping the flask in foil

– Loosen the nut on top of the lid assembly and slide the corresponding half of the ceramic part of the lid assembly out

– Fit the neck of the flask in the center hole of the ceramic lid assembly with the lip of the flask fitting into the groove at the base of the center hole on both sides

– Guide the thermocouple wires in the gap between the two ceramic halves so they are out of the way when the flask/lid assembly is inserted into the furnace

– Slide the loose half of the ceramic back in to be snug around the flask neck and tighten the nut on the top to hold it in position
   * The two halves nearest to the top of the assembly should meet or very nearly meet; if they don't then some foil should be removed from the neck of the flask
   * Use a circular spring to help hold the halves together

– Make a "donut" of foil wrapped around the neck of the flask that will rest up against the bottom of the lid assembly

– Slide the foil "donut" up so and press it so it is flush against the ceramic and restricts air flow around the opening

– Carefully turn the flask/lid assembly over making sure the flask doesn't fall out
   * **Do this over a table or close to a level surface to avoid accidental breaking of the flask**

* The flask will fit into the lid assembly somewhat loosely, but it shouldn't fall out
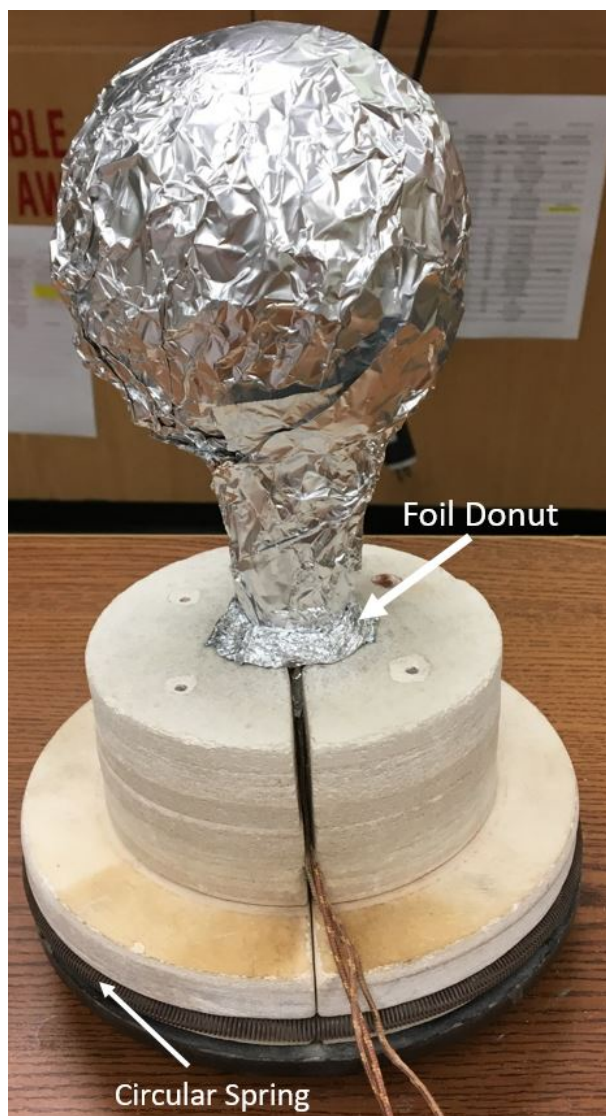* If the flask falls out, remove it and add more foil around the neck

Figure 2: Final state of the flask/lid assembly

– See Figure 2 for the final flask/lid assembly before insertion into the furnace
– Place the prepared flask/lid assembly into the furnace by gripping the assembly with both hands by the screws on top and slowly lowering the assembly into place
– Turn the flask/lid assembly so the thermocouple wires point away from where researchers will be working
– Insert flask interior thermocouple (#4) carefully down the flask neck, making sure it goes straight in and the bead doesn't get caught anywhere
    * The bead of Thermocouple 4 should be suspended in the approximate center of the flask, not be touching any part
    * The wire of Thermocouple 4 should run up the edge of the neck and not the middle to allow compound to be injected without making contact with the thermocouple
    * Use the bracket on one of the two screws on top of the lid to secure the rubber hose holding the thermocouple in place

* Tighten the nut on the bracket hand tight and then give a half turn with a wrench to secure the nut (See Figure 3)
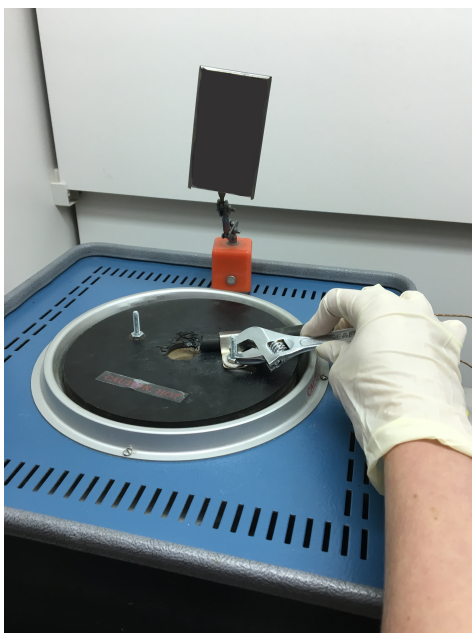

Figure 3: Position thermocouple 4 with the rubber hose and tighten

– Connect the thermocouples to the TA-DA
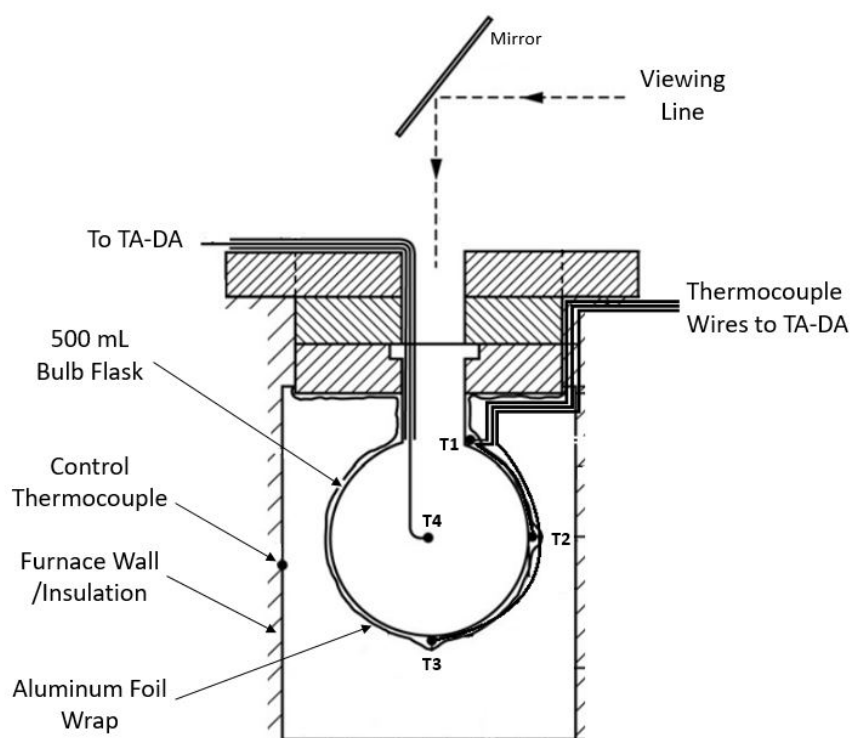– The final setup should resemble Figure 4

Figure 4: Diagram of the furnace when assembled

- Flask Cleaning

  For consistent experimental results, flasks must be as clean as possible (See Figure 5). Dirty flasks can terminate radical reactions and artificially raise the AIT. To ensure flasks are as clean as possible before use, the following steps are required for flask cleaning:

  - Always begin by soaking the inside of the flask with soapy water for 12 - 24 hours, regardless of how dirty it is
  - While soaking, the flask should always be secured to a ring stand
  - Wash out flask with soap and water, scrubbing the inside with tube brushes
  - For difficult stains, soak the flask inside with soapy water for another 24 hours or longer if needed
    * During this process, scrub the inside and replace the soapy water on a regular basis (generally every 12 - 24 hours)
  - Once all stains have been eradicated from the inside of the flask and the flask has been scrubbed in soapy water, rinse the inside and outside of the flask thoroughly
    * Using hot water for rinsing is preferred but not required
    * Rinse with tap water a minimum of 3 times, filling the flask with water, agitating the water for about 10 seconds, and then dumping the water
    * Repeat this process with distilled water available from the smaller tap on the Northeast corner of the lab sink
  - If hard water spots or salt deposits appear on the inside of the flask, rinse the inside of the flask with a small amount of vinegar to remove the deposits and repeat the rinse procedure above
  - Once the flask has been cleaned and rinsed thoroughly, place the clean flask on the drying rack over the sink

Figure 5: A clean flask (dirty flask in the background)

1.2 Furnace

- The furnace, shown in Figure 6, is an encased stack of ceramic insulation with cavities cut out to allow space for the heating elements and the test flask (see Figure 4 for an internal diagram of the furnace). The furnace is controlled with measurments taken at the insulated furnace wall. This design causes the furnace to have large temperature gradients while in operation. As a result, the setpoint temperature and the flask temperature will almost always differ significantly (as much as 25 K in some cases). Therefore, setpoints must be chosen between approximately 10 - 20 K above the desired temperature to reach that temperature inside the flask. **The reported AIT must be taken from the internal flask temperature (Thermocouple 4) and NOT the control thermocouple inside the furnace**
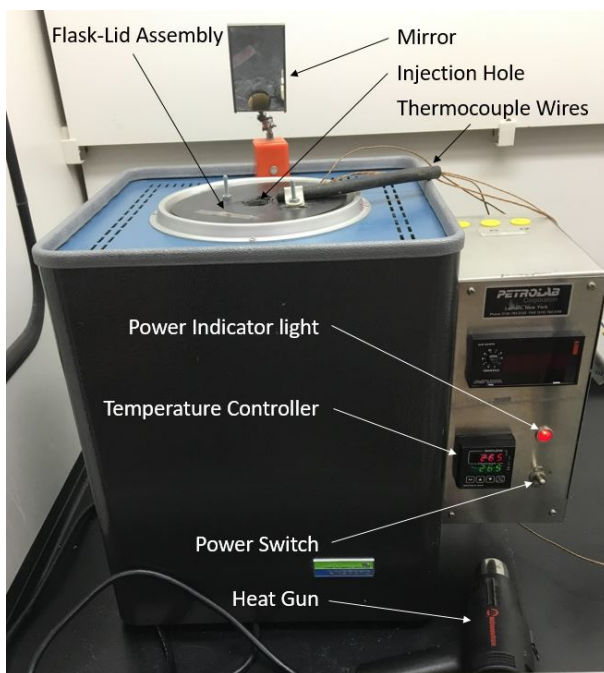

Figure 6: AIT Furnace

- When powered on initially, the furnace may take up to 2 hours or more to reach a desired temperature and thermally eqilibrate

- Any time a desired temperature is reached, allow at least 30 minutes for thorough thermal equilibration in the flask; allow extra time during initial start up

- Furnace Operation (See Figure 6):

  – Plug in the 220 V extension cord in the corresponding outlet on the wall opposite the hood (adjacent to the DSC computer)

  – Plug in the furnace to the 220 V extension cord

  – Power on the furnace with the power switch and use the temperature controller to choose a setpoint temperature

  – To change the set point, press the up or down arrows until the desired temperature is reached

  – The lower (green) display is the setpoint and the upper (red) display is the control thermocouple temperature

– When shutting down, turn off the power switch, unplug the furnace and unplug the 220 V extension cord from the opposite wall

1.3 Camera and Tablet

- Prior to using the experimental setup, all researchers must become familiar with basic use and operation of the GoPro© HERO4 Session™ camera and the Samsung Galaxy Tab A Tablet.

  More detailed instructions on how to do basic tasks may be found at the following URLs:

  – `https://shop.gopro.com/softwareandapp`

  – `https://gopro.com/help/articles/Block/How-to-Pair-the-Camera-with-the-GoPro-App#HERO4 Session`

  – `https://gopro.com/help/articles/Block/Getting-Started-with-the-GoPro-App`

  – `http://www.samsung.com/us/support/owners/product/galaxy-tab-a-8-0-wi-fi`

1. Camera Status Screen
2. Shutter/Select Button [⊙]
3. Microphone
4. Camera Status Light (red) / Wireless Status Light (blue)

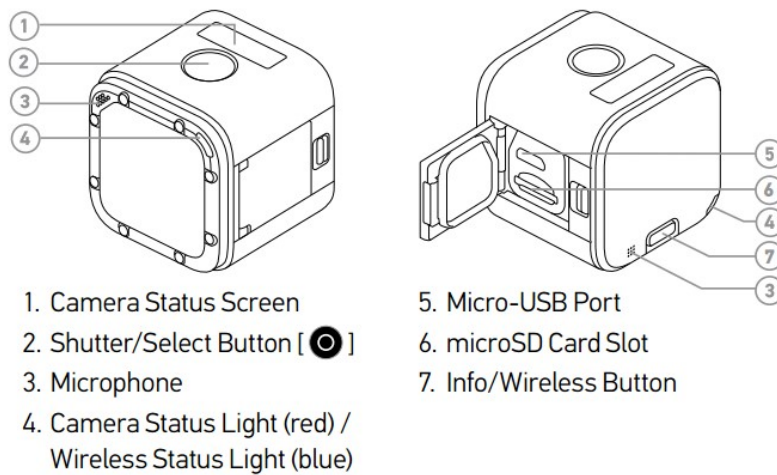5. Micro-USB Port
6. microSD Card Slot
7. Info/Wireless Button

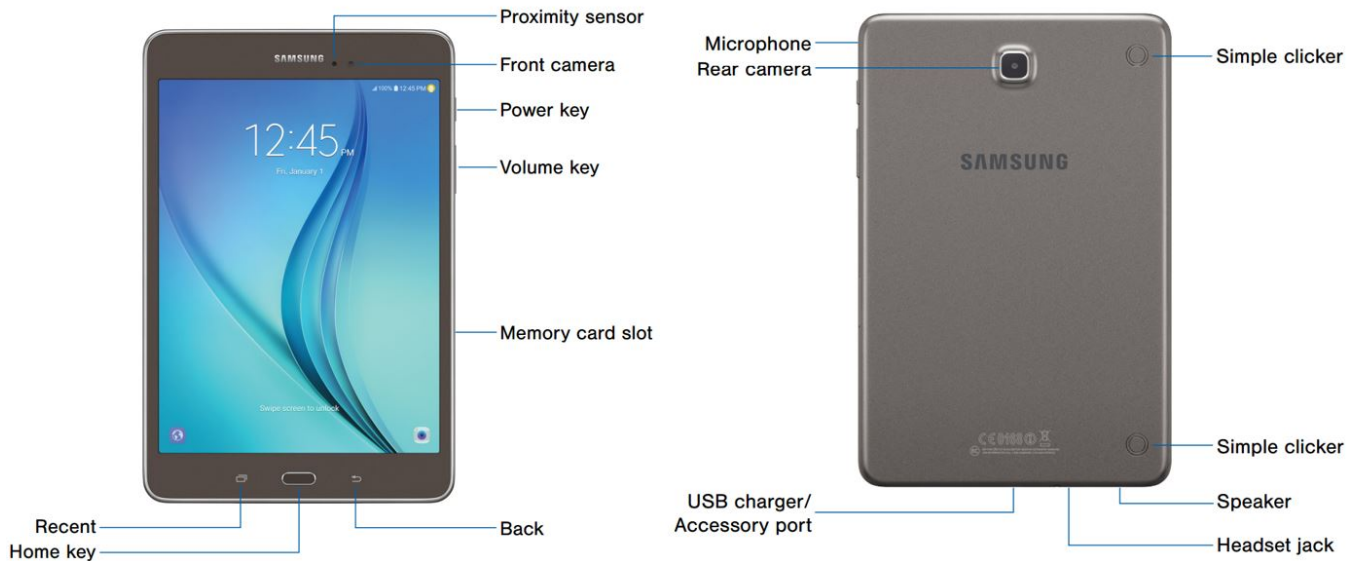Figure 7: GoPro© HERO4 Session™ Camera Parts

Figure 8: Samsung Galaxy Tab A

- Refer to Figures 7 and 8 for camera and tablet setup

- Connecting to the camera:

    - Press the "info/wireless" button on the back of the camera until you see "APP" on the camera status screen

    - Press the "shutter/select" button to confirm your selection

        * The "wireless status" (blue) light will begin flashing. This indicates the camera is broadcasting a Wi-Fi signal

    - Power on the tablet by holding down the power key until you see splash screen indicating the tablet is booting up

    - Once the tablet has booted, swipe to get to the home screen and select the "Settings" app

    - Select the Wi-Fi settings at the top of the list on the left side of the screen

    - Select the Wi-Fi network labeled "ait_cam_2016" then select "connect" on the message box that pops up (FYI: the wifi password is "hotflame16")

    - Once the tablet has connected to the Wi-Fi, return to the home screen by pressing the home key

    - Open the GoPro Capture App (app is labeled "Capture" on the home screen)

    - Select the connect box on the top left corner of the screen

    - Press the camera icon in the center of the screen

        * The camera will make a beeping noise and the camera view will open on the tablet

- Camera operation:

    - All operations may be done remotely on the tablet via Wi-Fi or directly with the "info/wireless" and "shutter/select" buttons on the camera. For experimental purposes, only basic operations will be covered. For more detail on camera operation please see the URLs above

    - In the camera's off or normal modes the "shutter/select" button toggles recording or standby; the camera will automatically shut off after a few seconds on standby

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- – If the camera is remotly controlled, the on screen red button toggles recording or standby
- – During recording, the camera will not allow viewing via the tablet. This is due to the high framerate of our experiments
- – Captured video may be reviewed and managed remotely with the grid button on the bottom left corner of the screen
- – The camera may be powered on and off remotely with the power button on the top right corner of the screen. The camera should be powered off between experiments or when not in use

- Shutdown:

  - – To shutdown the camera:
    - ∗ Press the "info/wireless" button until the camera status screen reads "Turn Wi-Fi Off"
    - ∗ Press the "shutter/select" button to confirm your selection
      - · The "wireless status" (blue) light will stop flashing
    - ∗ Press the "info/wireless" button until the camera status screen reads "Exit"
    - ∗ Press the "shutter/select" button to confirm your selection
      - · The camera will shutdown
  - – To shutdown the tablet:
    - ∗ Press the "Recent" button to bring up all opened programs and close all programs by swiping on them or pressing the 'X' in the top right corner
    - ∗ Press and hold the Power key until the option to power of pops up then press power off
      - · The tablet will shutdown

- Batteries:

  - – Recharging power supplies and usb cables are availible for both the tablet and camera
  - – Both the camera and the tablet may be charged while in use
  - – Do NOT charge tablet with the computer as it does not deliver enough current for effective charging
  - – Batteries should be allowed to discharge to between 10 - 20% before recharging
  - – Batteries should always be recharged to 100% capacity before unplugging
  - – Do not overcharge any battery. Do not leave any battery charging overnight

2 Measurement and Data Collection

This section enumerates the procedure for measuring AIT. Researchers should follow these procedures every day and for every experiment performed to ensure consistent results. The first priority should always be safety. Therefore, if any step of this process is found to be unsafe or pose an unacceptable risk it should be changed. Furthermore, changes should be made if any step of the process violates the ASTM E659 Method to conform to the requirements of the method.

2.1 Startup

1. Ensure the lid is off the pressure vessel and the vessel is being vented by the snorkel

   - Under normal operation, the vessel should be vented with the snorkel any time the vessel is open
   - The only exception to this rule is when the experimental setup has been shut down for an extended period of time for maintenance purposes

2. Ensure the ARIA lead screws are set such that the ARIA is in the shutdown position

3. Ensure the three molex cables are securely plugged in to the ARIA and will not come out while the ARIA is moving

4. Align the ARIA so that the needle or funnel is aligned to the center of the injection hole in the top of the furnace

   - You will need to install the appropriate setup for the compound you intend to test that day
   - After alignment, remove any setup materials used to reach alignment

5. Plug in the ARIA control to the 5 volt power supply and wait for initial setup sequence to complete (The two button lights on the ARIA control will come on)

6. Ensure the furnace is plugged in

7. Power on furnace and set furnace temperature between 20 - 30 degrees above your initial target flask temperature

8. Reduce the set point temperature when the internal flask temperature exceeds your initial target temperature by 5 - 10 degrees

   - Wait a minimum of 90 minutes before changing the temperature
   - When powered on initially, the furnace may take up to 2 hours or more to reach a desired temperature and thermally equilibrate

9. Start up computer and log on

   - Use your CAEDM account to log in
     - You should be able to access all the needed tools and programs from your account
     - If you cannot access a program or file from your account, let me know and I will give you administrator access as needed
   - You may need to specify the domain you are logging into. If that is the case enter your CAEDM credentials in as follows:

- Username: CAEDM_AD*your_caedm_username*
- Password: *your_caedm_password*

10. Ensure a compatible SD card is inserted securely into the TA-DA datalogger

11. Ensure the thermocouples are connected to the TA-DA

12. Connect the TA-DA to the lab computer via the USB cable mounted under the edge of the hood

13. Plug in the 24 volt power supply to the TA-DA

14. Open the TA-DA user interface program

   - Path: $C:nUsersnPublicnDocumentsnAITnait_expnTADAnTADA\_UI.py$
   - You may wish to make a shortcut to this location and put it on your CAEDM desktop.
   - Upon opening the program, a yellow LED in the TA-DA should begin flashing (See Figure 9)
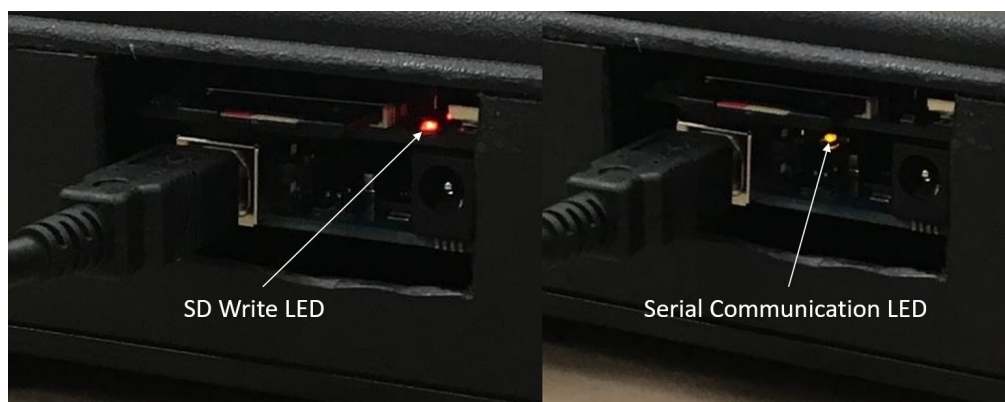

Figure 9: Control LEDs inside the TA-DA

15. Press the "Sync Time" button on the bottom left corner of the TADA_UI window to syncronize the Arduino clock to the computer time

   - This must be done at least once every work day

16. Use the TADA_UI program to track the internal temperature of the flask as it heats up initially

17. Prepare the tablet and the camera

   - Power on the tablet and connect it to the camera's Wi-Fi (See Section 1.3 on how to do this)
   - Open the capture app to view the camera's view finder
   - Mount the camera on the tripod using the quick-release plastic camera mount on top of the tripod
   - Using the camera's view finder on the tablet, adjust the position of the camera, tripod, and mirror on the furnace to align the camera's view to see through the sight glass directly down the center of the flask
     - The camera should be positioned approximately level with the top of the furnace looking slightly upward into the mirror
     - For the best view, the camera should be as close to the sight glass as the tripod will allow and pointed directly into the mirror

- Gently tighten the knobs on the tripod to fix the camera in place

18. Once the target temperature is reached, allow 30 minutes for thermal equilibration then begin experiments

2.2 Experimental

This section outlines the steps for experimental runs. Each experiment should be performed following these steps exactly (insofar as that is possible). Doing so will ensure consistent results with the lowest uncertainty possible.

1. In the TADA_UI program, press the "Choose Target File" button and choose where to save your file

   - Save all temperature data files in comma separated values (.csv) format
   - Path: *C:\Users\Public\Documents\AIT\data\compound_name\filename.csv*
   - File naming convention:
     - Filenames will be organized by the following values in order separated by underscores ("_")
       * Compound name
       * Phase of the compound ('g' for gases, 'l' for liquids, 's' for solids)
       * Date of experiment with the format "YYMMDD"
       * Time of day that data collection began for that run using a 24 hour clock format "hhmm"
       * Sample size in microliters (for liquids) or milligrams (for solids and gases)
       * Test temperature in degrees Celsius (rounded to the nearest integer)
     - For example: The filename of an AIT experiment where 100 microliters of liquid hexane were tested at 450 °C on March 19, 2013 at 4:25 pm would be:
       "hexane_l_130319_1625_100_450_.csv"
   - This action will reset the TA-DA for the next measurement

2. **Safety: Ensure you are using proper PPE and have minimized hazards in the lab environment before continuing**

   - Ensure your workspace, the area around the computer and both hoods are free of clutter, tripping hazards or any object which could present a hazard to you or anyone else in the lab
   - Appropriate PPE (e.g. nitrile gloves and splash goggles) are required when handling chemicals
   - Refer to the SDS for the chemical you are working with when determining appropriate PPE
     - NOTE: Some SDS's will recommend using a face shield in addition to splash goggles when handing their respective chemicals. In our lab we will use ventilation hoods which, when used properly, serve as better protection than face shields. Therefore, any time an SDS recommends using a face shield you may safely ignore that recommendation provided you are using the hood properly by positioning the sash between your face and the work being performed in the hood.
   - Unless an SDS states otherwise, lab coats are recommended but not required when handling chemicals

- All chemical handling (except for injection into the furnace) should be done in the left hood to avoid a potential fire hazard

3. Measure out sample

  - Liquids
    - Draw sample amount into a right-angle syringe
  - Solids
    - Tare the lab scale with the weigh boat and measure out sample
  - Gases
    - Draw sample amount into a right-angle syringe

4. Adjust mirror so you can see into the flask

5. Prepare sample on ARIA

  - Liquid/Gases Sample beginitemize
  - Place syringe into syringe holder on ARIA, making sure the tip of the syringe is aligned with the hole in the furnace lid

6. Solid Sample

  - Carefully insert weigh boat onto holder on ARIA, making sure that it is secure
  - As securely and vertically as possible, place the funnel on the ring stand arm of ARIA

7. If it is the first run of the day, ensure that ARIA is in the lowered position.

  - If it is not in the lowered position, manually lower it until it is touching the plate.
  - Plug in the ARIA power source and allow it to reach stand-by position. The LED lights will be lit, indicating it is in stand-by mode.

8. If it is not the first run of the day, ensure that ARIA is in stand-by mode and the arm is in the raised stand-by position. The LED lights will be lit, indicating it is in stand-by mode.

9. Place lid on pressure vessel and secure in place with the clamps.

  - Tighten in a star pattern

10. Note the absolute pressure in the lab on the barometer mounted on the east wall by the fume hood and write down the pressure in the lab notebook

11. Pressurize vessel

  - Open the pressure transducer measurements by going to the TADA firmware Arduino file and clicking "Serial Monitor" in the top right-hand corner.
  - Adjust pressure in vessel using air tank valve until the pressure in the vessel and the absolute pressure of the lab add up to 1 atm (760 torr)

12. Remove any glove from your LEFT hand and use your left hand for touching any non-hazardous surfaces

13. Ensure the lab is sufficiently dark to see any flame from the mirror on top of the furnace

14. Begin data collection

- Use your left (ungloved) hand to press the Enter key
- A red LED in the TA-DA should begin blinking
- The TA-DA UI will keep track of the elapsed time since data collection began at the bottom of the window. This may be used to time the experiment

15. With your LEFT (ungloved) hand, press the red button on the tablet screen to start recording

16. Press the LED button on the ARIA control box that corresponds to the physical state of the sample (green for solid, blue for liquid) to initiate ARIA sample injection.

17. Watch the mirror above the furnace for any flame/glow or the TA-DA UI for a large temperature spike for 10 minutes

- If a flame, glow or spike is observed, stop the camera after the flame disappears and then allow enough time for the temperature to return to a steady state before terminating temperature data collection
    - If the flame is bright yellow/orange, this is considered a hot-flame autoignition
    - If the flame is faint and blueish, this is considered a cool-flame autoignition
- The experiment ends when one of the following criteria is met:
    - An ignition event is observed (i.e. a temperature spike or seeing a flame) and the temperature returns to steady state
    - 10 minutes pass with no ignition event observed
- If the UI is used to keep track of time and no flame is observed, continue collecting temperature data until 600 seconds have passed since injection

18. Record pertinent data and observations in the lab book and the TA-DA UI

- The following data must be present on the same row, in the following order:
    - Time of day that data collection began for that run
    - Compound name
    - The lot number and/or sample number of the container (This only needs to be recorded in the lab book and only once for every compound container)
    - Phase of the compound upon injection ('g' for gases, 'l' for liquids, 's' for solids)
    - Sample size in microliters (for liquids) or milligrams (for solids and gases)
    - Set-point temperature of the furnace
    - Test temperature in degrees Celsius (rounded to the nearest integer)
        * This should be the internal flask temperature (Thermocouple 4) prior to injection
    - Indicate whether an ignition event was observed (i.e. Did you or the camera see a flame?)
    - Indicate whether a hot flame or cold flame was observed (if applicable)
    - Indicate if any sound was heard upon ignition (if applicable)
    - The total barometric pressure, the ambient room pressure and the pressure vessel gauge pressure at the time of the experiment(in mmHg)
- If any item is not applicable write down N/A in its place
- If any item is unknown, leave a blank until it can be determined
- Optionally, leave any pertinent comments about the experiment next to or directly under this row of data
- Record the same data in the corresponding fields in the TA-DA UI **before** terminating temperature data collection

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19. After the experiment ends, terminate data collection

   - Press the Enter key again to stop data collection (the red light on the TA-DA should stop blinking)
   - Press the red button on the tablet screen to stop recording
   - Turn the lights back on
   - Video recording may be stopped as soon as a flame or glow disappears

20. Wait the specified time to allow for the pressure vessel to be purged

21. Turn off the inlet air flow and wait for pressure vessel to FULLY depressurize

22. Place snorkel over furnace and remove the pressure vessel lid.

23. Prepare for the next measurement

   - Set furnace to next temperature
     - When changing temperature, always approach your target temperature from 5 - 10 degrees Celsius above and then descending slowly to your target temperature
     - This practice is intended to control for hysteresis effects (See Section **??**)
   - Clean out the flask between measurements by blowing hot air into the flask for 5 minutes using the heat gun
     - The heat gun should **only** be plugged in to the outlet when in use
   - Extract, save and appropriately rename the video data between experiments
   - Wait a minimum of 30 minutes to reach the new temperature and allow the furnace and flask to thermally equilibrate

24. Start this procedure over from step 1 (measure the pressure)

2.3   Shutdown

- The following should be done before leaving the lab at the end of every work day or any time the setup is not in use:
  - Power off the furnace
  - Unplug TA-DA from the computer
  - Tuck the end of the USB cord into the mounted section under the edge of the hood so it does not present a tripping hazard
  - Extract all data to the computer and appropriately rename them (Refer to section 5)
  - Shut down and unplug the tablet and the camera
  - Remove the camera from the tripod using the plastic quick-release lever and store the camera next to the lab computer
  - Put all chemicals and syringes away in their proper places
  - Remove any organic solid residue from all working surfaces (See Section 4.2)
  - Close all programs and shut down the computer
- A hot furnace may be left in the hood without waiting for it to cool
- Do not rinse out needles
- Under normal use, disposable gloves may be thrown into the normal trash receptacle instead of solid chemical waste

3 Data Extraction

During experiments data are being recorded on the lab computer, the datalogger and the camera. Both the camera and the datalogger on the TA-DA have SD cards with a 32 GB storage capacity that allows multiple runs to be recorded without extraction. The following policies are in place to ensure ease of use, efficiency and avoid common mistakes.

- For the AIT setup, do not exceed 10 runs without extracting temperature data to the computer and deleting the data from the SD cards.

- All data should be extracted at least *daily*

- Video data should be extracted and properly renamed as often as possible (i.e. between every run or every other run) to ensure the correct filenames are assigned to their corresponding video files

- File naming convention:

    - Filenames will be organized by the following values in order separated by underscores ("_")
        * Compound name
        * Phase of the compound ('g' for gases, 'l' for liquids, 's' for solids)
        * Date of experiment with the format "YYMMDD"
        * Time of day that data collection began for that run using a 24 hour clock format "hhmm"
        * Sample size in microliters (for liquids) or milligrams (for solids and gases)
        * Test temperature in degrees Celsius (rounded to the nearest integer)
    - For example: The filename for temperatures from an AIT experiment where 100 microliters of liquid hexane were tested at 450 °C on March 19, 2013 at 4:25 pm would be:
    "hexane_l_130319_1625_100_450.csv"

- Video and datalogger data must be processed (i.e. parsed, edited, timestamped etc.) before being organized and therefore will be saved to a different path initially

- After processing, all data should be organized according to the following path convention:

    - Path: *C:\Users\Public\Documents\AIT\data\compound_name\filename.ext*
    - All data, including videos, from the same run should have the same filename and path but different extensions except data from the datalogger
    - The datalogger filename convention should also have '_dlog' at the end of the name to distinguish it from the UI generated file (e.g. "hexane_l_130319_1625_100_450_dlog.csv")
    - When processing is finished all runs should have the following 4 files with the same name preceding them
        * A .xlsx file (for temperature data w/ graphs and analysis)
        * A .csv file (UI generated)
        * A _dlog.csv file (datalogger)
        * A .avi/.mp4 file (video)

- The camera may be plugged in via USB and video extracted with GoPro© Quik software

    - Connect the camera to the computer via a micro USB cable (See Figure 7)
    - Press the "info/wireless" button on the camera to connect the camera to the computer

- Quik should be configured to open automatically extract video and erase the microSD card when the camera connects to the computer
- Video files should be extracted to the DIPPR legacy server and organized by date:
  * Path: \\\dipprlegacy.et.byu.edu\aitra\video_import
  * Username: dipprleg\aitra
  * Password: hotflame16
- If Quik is not configured to do this refer to the Quik manual for how to configure this (or ask me and I will configure it)
  * C:\Users\Public\Documents\AIT\docs\GoPro_App_for_Desktop_User_Manual.pdf
- Once extracted to the DIPPR legacy server, video data may be timestamped and converted to .avi format on the server (See Section ??)

- To extract data from the datalogger

  - Unplug the TA-DA from the computer
  - Pull out the SD card from the datalogger and use the USB SD card adapter to copy the"DATALOG.CSV" file into the "raw_data" path and rename it to the original filename with the date tagged on in "YYMMMDD" format (e.g. "DATALOG_130319.CSV")
    * Path: C:\Users\Public\Documents\AIT\data\raw_data
  - Open the "DATALOG.CSV" file on the SD card, erase all data from it and save it, making sure to not change its name, extension or file path
  - Close all windows with the USB SD card adapter open (i.e. Excel files, Windows Explorer etc.)
  - Pull out the SD card without ejecting the unit from the computer

- Ensure all files from the camera and datalogger are deleted after they have been properly saved in the data folder

4   Spill Clean-up

In the event of any spill, appropriate PPE specified in the corresponding SDS should be used in clean-up. Always check the SDS for special considerations when cleaning up any compound.

4.1   Liquids

- In the event of a small spill (i.e. less than 100 ml), the following protocol should be followed:
  - If the spill occurs in or out of the hood, use absorbent clay that can be found under the counter west of the sink to soak up the bulk of the liquid and wipe up the rest with a paper towel
  - Dispose of the clay, any disposable gloves and towels in the solid waste container
- In the event of a large spill (i.e. greater than 100 ml), the following protocol should be followed:
  - If the spill occurs in the hood, use absorbent clay that can be found in the lab to soak up the bulk of the liquid and wipe up the rest with a paper towel
  - Dispose of the clay, any disposable gloves and towels in the solid waste container

- If the spill occurs outside the hood or the spill is particularly large (e.g. an entire bottle of a flammable material breaks) **perform the Emergency Shutdown Procedure (Section 5), evacuate the lab and call: BYU Risk Management and Safety - (801)-422-4468**

- Spills involving compounds that are particularly toxic or unstable should always be considered large spills

4.2 Solids

We will generally work with organic solids that readily dissolve in acetone. Researchers must always check chemical compatablity with acetone before dissolving any compound in acetone.

- Small amounts of organic solids may be dissolved in a small amount of acetone and put in organic liquid waste

- Larger amounts of solids should be transferred to solid waste and the residue should be dissolved in acetone and discarded in liquid waste

5 Emergency Shutdown

- In the event of an emergency do the following:

  - Power off the furnace
  - Unplug the furnace
  - Stop the camera recording (if applicable)
  - Shutdown and unplug the camera and tablet
  - Close all programs and shutdown the computer

- If an emergency requires you to evacuate the lab, do only the first 2 steps