Lycopodium Powder Combustion

Chemicals and Equipment Needed

- Jar of lycopodium powder – **F3**
- Lycopodium can – **N5**
  - Replacement candles – **N4**
- Propane torch – **A4**
  - No stand needed
- Stick lighter – **U1**
- Striker – **U2**
- Ceramic mat – **U4**
- Mallet – **U2**
- Fire extinguisher – **next to A**

Hazards

- Some students may be allergic or sensitive to the particulate produced by the explosion, so it is best to do this demo at the end of lecture, if possible.

Preparation

- Fill the funnel halfway with new lycopodium powder. Inspect the candle and make sure the wick looks long enough to light easily.
- On delivery, place the can on the floor, along with the stick lighter, mallet, and fire extinguisher. Place the ceramic mat on the benchtop and pour enough lycopodium on top to make a small pile. Set the propane torch and striker nearby.

Presentation

- Use the propane torch (or stick lighter) to light the pile of lycopodium. It may char and smolder, or catch fire and burn slowly with a small flame. The pile burns slowly because it has limited contact with the air, and therefore limited contact with O_2.
- Now use the can to show them a dust explosion. You may want to mention the epidemic of silo explosions in the ‘80s because of aerosolized grain particulate. Light the candle and place it inside the can, opposite the funnel. Use the mallet to lightly hammer down the lid.
- Take a few steps back, and squeeze the blood pressure bulb. There are two techniques to this. You can hold the bulb in your dominant hand and cover the valve at end with your other hand, and squeeze firmly. You can also give the bulb several quick, hard squeezes. The point is to blow enough powder into the vicinity of the flame to make it explode
- Results for this demonstration vary. Sometimes the lid is blown off completely, other times it lifts up on one side and flames shoot out.

Discussion

- In the paint can explosion, a fine spray of lycopodium powder is blown into the air inside the can. Exponentially more surface area is exposed to the oxygen in the air, so the reaction is much faster. The rapid production and expansion of hot gases (CO_2 and H_2O) blows the top off the can.

Clean-Up

- Scrape the burned lycopodium into the trash, and clean off the bench with a wet paper towel if necessary.

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NOTES:

- Alternatively, you can blow lycopodium powder through a flame. Attach a plastic funnel to a length of tubing, and insert a tubing connector (**U1**) in the other end to use as a mouth piece.
    - Already assembled apparatus should be on **N5**
- Scoop two scoopulas worth of lycopodium powder into the funnel. Light a votive candle and place on an overturned beaker or crystalizing dish. Position yourself so that the mouth of the funnel is below the candle, pointing up. Take a big breath and blow the powder through the flame. You will hear a faint whoosh and see a large fireball from the aerosolized powder.
- Don't inhale.
- If in MP1015, have students move away from the front row.

To make a new paint can:

Equipment needed

- Paint can
    - We use the can that Magnesium powder comes in
- 6-8 feet tubing
- Glass funnel with long stem
- Blood pressure bulb
- Votive candle
- Jar lid

Construction

- Have the glass blower bend the stem of the funnel 90°. The bend should occur 4-5 cm below the funnel, and the other side of the bend should be trimmed to 4-5 cm as well, with an oblique end to the stem (diagonal cut). Have the glass blower trim the top of the funnel so that the cup itself is only 3-4 cm tall.
- Insert the funnel into the tubing, using dish soap or glycerol if needed, and take that and the can to the machine shop, and have them drill a hole in the paint can large enough to accommodate the funnel+tubing. Have them drill a much smaller hole (1/8" or 2 mm) underneath the larger hole. This is to prevent the creation of a vacuum in the can, which can result in implosion.
- Insert the funnel+tubing through the hole, and attach the blood pressure bulb to the other end. Make sure the funnel sits well in its hole, and does not fall over. It must remain upright for the demo to work.
- Place a votive candle in the lid and set on the inside floor of the can.
- Make sure to test this thoroughly before giving it out.