STANDARD OPERATING PROCEDURE
FOR BURNER EXPERIMENT

Revised 08/14/2013

1. Before experimental process be sure to wear appropriate PPE (e.g. goggles, gloves, laboratory coat, etc.)
2. Clean the screw and collar with denatured ethyl alcohol to remove any powder residue residing on the screw feeder. Completely air-dry all components.
3. Gather all materials needed for the loading of material: a clean plastic dish, spatula, short bristle brush, and mass balance.
4. Before loading, cover the threads of the end regions of the screw with masking tape. The end regions cannot feed powder since they are outside the physical reach of the capillary tube nozzle. A suggested clean offset length is about 1 inch from the front end of the screw.
5. Inside a fume hood, weigh desired amount of the powder under investigation in an aluminum/ plastic weighing dish and record the powder mass to the nearest 0.001 g. (Note that X65, spherical $\leq$ 20 μm aluminum powder was used in preliminary tests; 0.1 g was the default powder load.)
6. Position the screw horizontally above aluminum/ plastic weighing dish containing material. Apply the dry material with a short bristled brush against the threads of the screw. Turn the screw while applying the material. The screw should be loaded with material from the offset to a pre-selected length down the screw; 3 inches are loaded for example shown in Figure 1.
7. Insert the loaded screw into the collar. While inserting the screw into the collar, collect any excess powder that falls off the screw using a weigh dish.

Figure 1 Loaded screw with 1.4 inch offset after drying

8. Weigh the excess powder collected. (The loaded quantity of powder on the screw is the initial weight minus this measured weight. The mass loaded into the screw using this method should be about 0.1 g)
9. Attach the screw to the knuckle of the feeder and fasten the setscrews on the knuckle.
10. Place a rubber plug at the opposite end of the collar. This will reduce the chance that powder would be carried out the non-feeding end of the collar during operation.
11. Connect the central nitrogen flow tube and powder feed tube to the collar. Carefully fasten the powder feeder to the nozzle, exposing approximately 5 mm of the tip in the outlet of the nozzle.

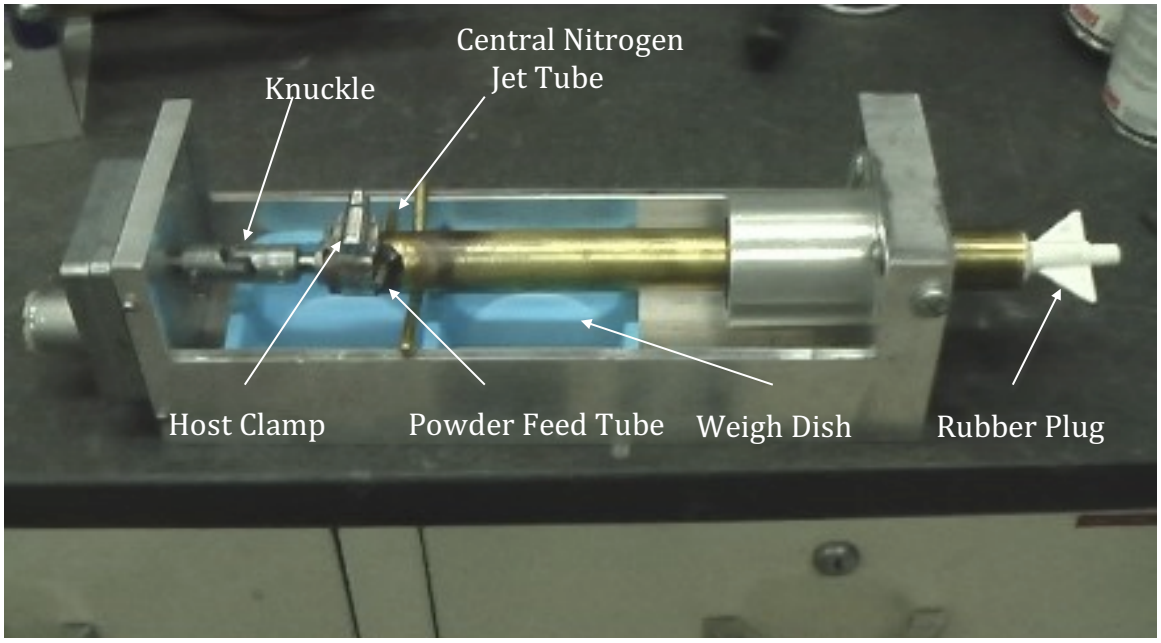

Figure 2 Loaded screw inside collar

12. Adjust the position of the dust collection ducting over the flame.
13. Set the acetylene and nitrogen flow rates and the air flow to desired flow rate and ignite the flame.
    Air: 10 scfh
    C_2H_2: 0.9 scfh
    N_2: 3.0 scfh
14. Adjust the nitrogen flow to obtain a backpressure of 4.0 psi along the collar.
15. Adjust the position of the top section of the burner to attain a symmetrical inner-cone using the setscrews on the burner.
16. Record length measurements from the LHS of the collar to the gas nozzle as means to know how much of the powder load has been used as an approximate point of reference.
17. Connect the screw feeder to an adjustable DC power supply (Voltage 0 – 30 V, current > 0.2 A).
18. Turn on power supply and set the voltage to commence the powder feed.
    Note: The total powder fed will be the mass minus the mass of powder collected in this step.
19. After experiment is complete, clean the screw feeder and designated area.

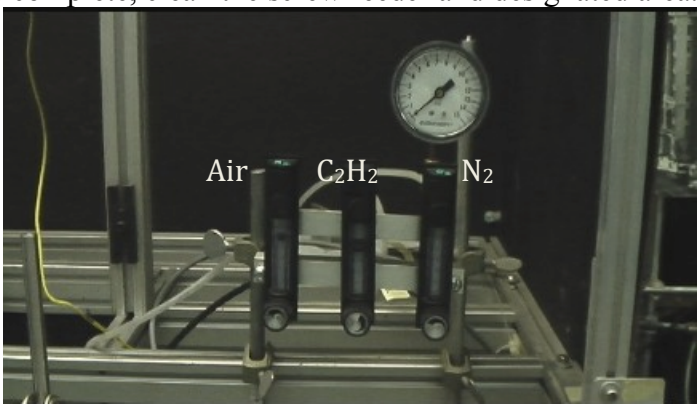

Figure 3 Rotameters for Air, Acetylene, and Nitrogen

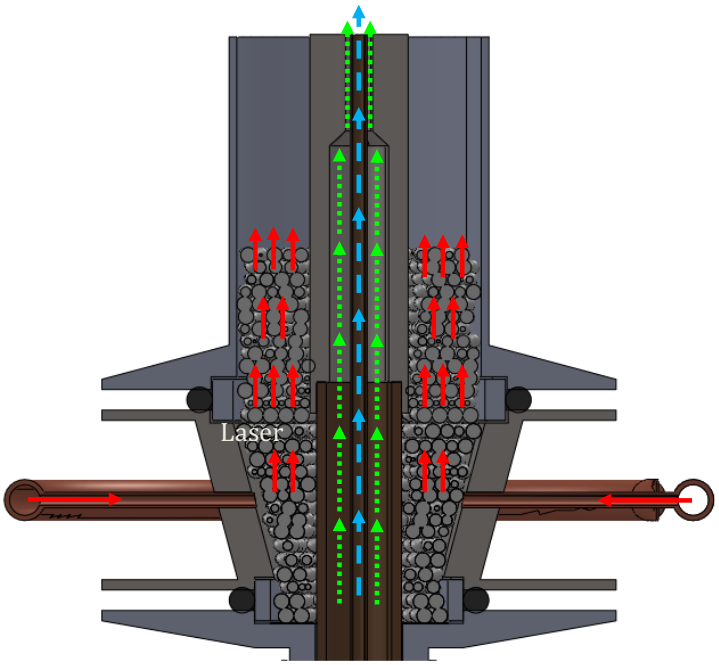

Figure 4 Burner Flow

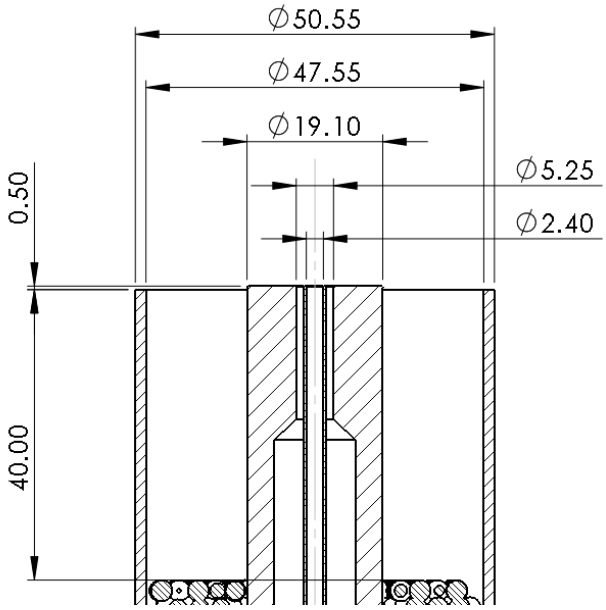

Figure 5 Burner Schematic

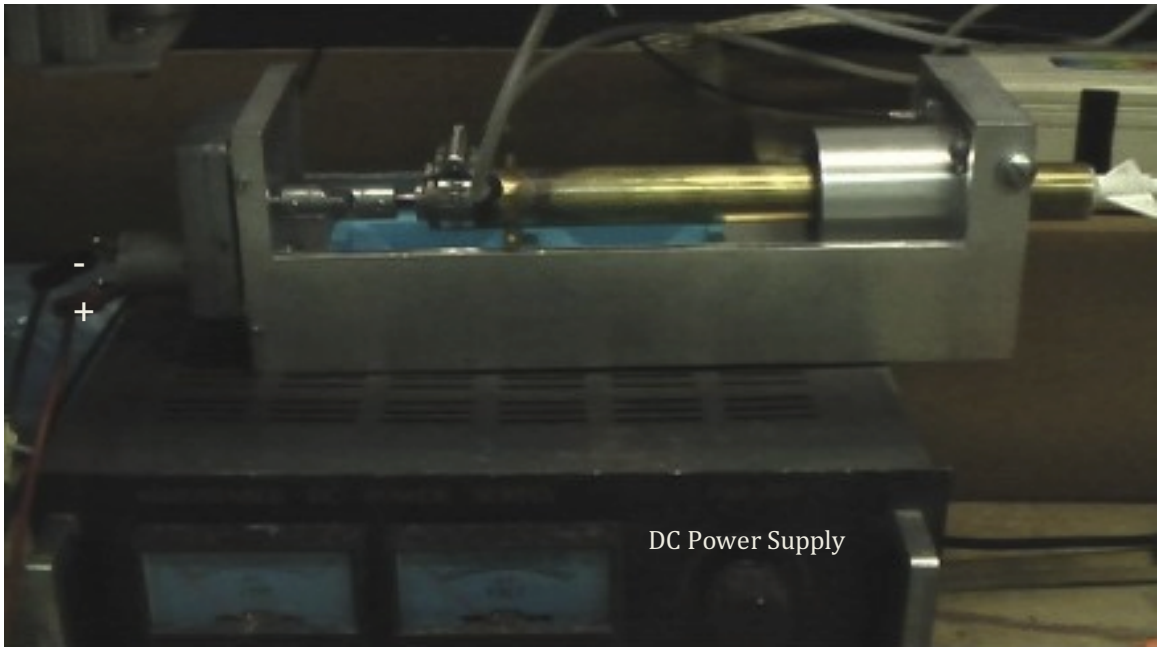

Figure 6 Screw Powder Feeder and Power Supply