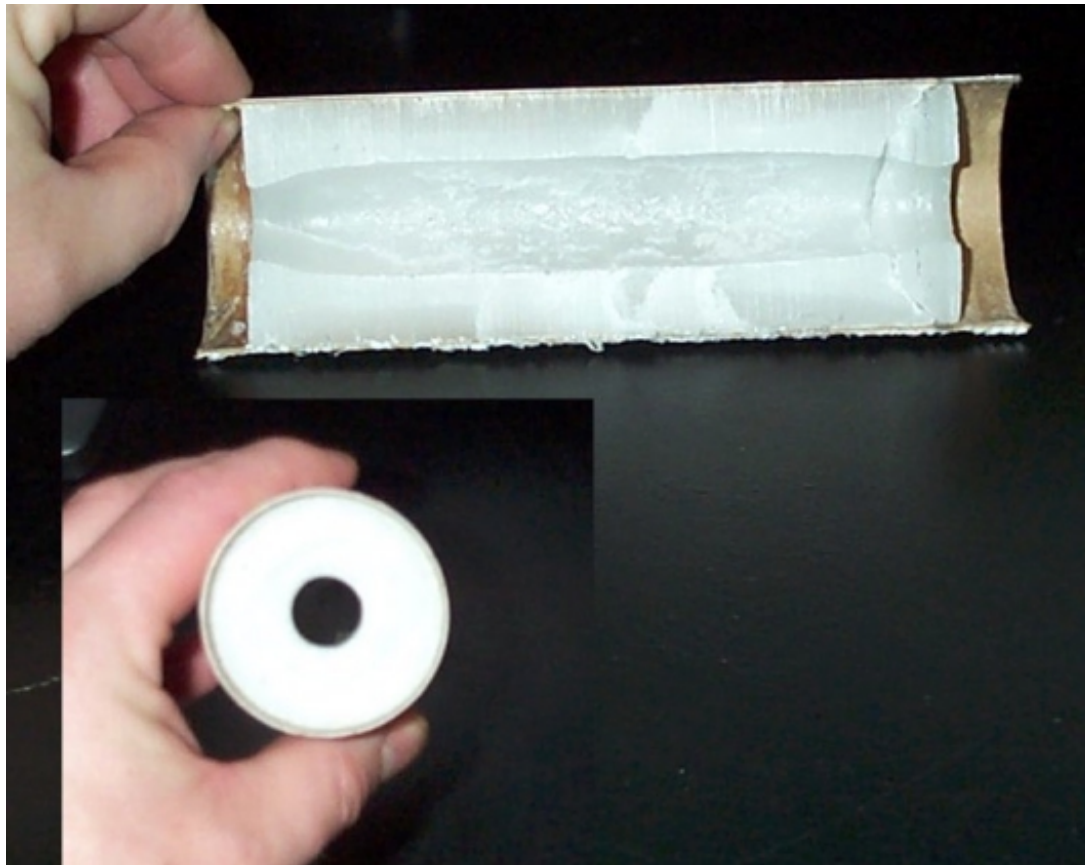


First spin Casting test - December 16th,2004



This first test was conducted specifically to see if a paraffin fuel grain could be spun-cast with the new apparatus. The initial volume measurement of the liquid paraffin is not exact because we didn't think to measure the height of the column of liquid paraffin before we sealed it up and put it in the spin caster. The 4.9 inches therefore is a estimate. (See calculations below)

Straight paraffin was used (160 deg hurricane wax) in our new 1.75" ID cardboard sleeve. The molten paraffin was then spun at an unknown RPM for a period of 2 hours and 3 minutes in a 65 F environment. We still need a method to measure RPM's but the lab power supply was set at 15v which may equate to around 1000 RPM's for our Kollmorgen motor.

Cracking in the paraffin grain is still noticeable. One end broke out while band sawing the grain in half for analysis. The ends of the port are slightly tapered, probably due to the paraffin cooling quicker against the aluminum plugs. The final measurement of 0.8 inches for the port diameter is also an estimate. It ranges from 0.65 inches at the ends to 0.82 inches in the center.

It is probably fair to say from this test that paraffin spin casting is possible for us, though our technique needs to be refined. Also the paraffin shrinkage is probably between 16-18%.

Calculations :

$$\text{Grain}_{\text{OD}} := 1.75\text{in}$$

$$\text{GrainLength}_{\text{initial}} := 4.9\text{in}$$

$$\text{GrainLength}_{\text{final}} := 5.1\text{in}$$

$$\text{GrainPort}_{\text{avg}} := .80\text{in}$$

$$\text{Volume}_{\text{liquidparaffin}} := \left(\frac{\pi \cdot \text{Grain}_{\text{OD}}^2}{4} \right) \cdot \text{GrainLength}_{\text{initial}}$$

$$\text{Volume}_{\text{liquidparaffin}} = 11.786 \text{ in}^3$$

$$\text{Volume}_{\text{solidparaffin}} := \left(\frac{\pi \cdot \text{Grain}_{\text{OD}}^2}{4} - \frac{\pi \cdot \text{GrainPort}_{\text{avg}}^2}{4} \right) \cdot \text{GrainLength}_{\text{final}}$$

$$\text{Volume}_{\text{solidparaffin}} = 9.703 \text{ in}^3$$

$$\text{PercentShrinkage} := \left(1 - \frac{\text{Volume}_{\text{solidparaffin}}}{\text{Volume}_{\text{liquidparaffin}}} \right) \cdot 100$$

$$\text{PercentShrinkage} = 17.669$$