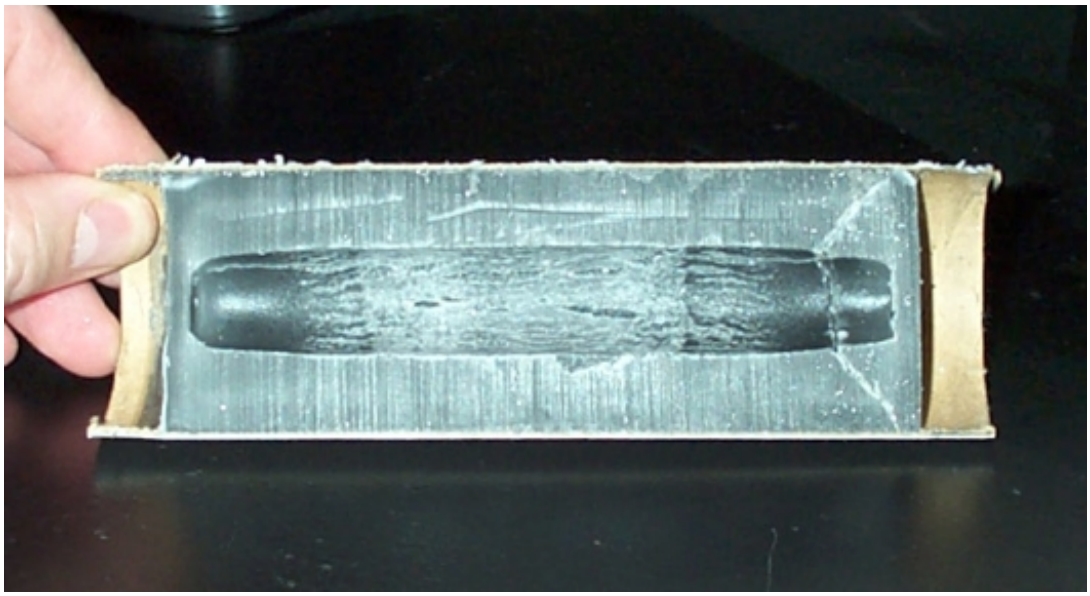
Third spin Casting test - December 19th,2004



The third test was similar to the second test. The same 1% graphite 99 % paraffin mixture was used. The grain was spun for 2 hours and 30 minutes in a 65 deg F environment.

The main difference was that the RPM were reduced to half the value they were in the second test. In the second test the lab power supply was set at 15v in this test it was set at 7.5v. We still don't have the tachometer hooked up but it is likely the RPM is around 500.

The stratification of the graphite powder is much less noticeable and the entire grain is black in color due to the graphite. There is perhaps a slightly darker region at the outer diameter. The central core still formed at the lower RPM so this seems like the way to go.

In addition a small vent hole (#42 bit) was drilled through the center axis of the driven aluminum plug. This was to allow the plugs to seat all the way down on to the cardboard liner. In the previous two tests the orings were making a very tight seal with the cardboard. There was a small pocket of air left inside the tube that would compress and not allow the plugs to seat properly.

With the plugs correctly in place the grain length became the correct 5.0 inches instead of the 5.1" on the previous tests. this shorter grain length caused the central port to be slightly smaller in diameter also. The shrinkage rate this time was just under 15%.

The ends of the grain is show in the above picture before the wax plugs over the ends were removed. On this test they were a little thicker than before and could not be knocked out by pressing on them with your finger.

Surface cracks were again noticed on the inside surface of the grain port, this time a bit larger. As well as the dome shaped crack on the drive plug end. Still not sure what is causing that.

Calculations :

$Grain_{OD} := 1.75in$ $GrainLength_{final} := 5.0in$

$GrainLength_{initial} := 4.9in$ $GrainPort_{avg} := .71in$

$$Volume_{liquidparaffin} := \left(\frac{\pi \cdot Grain_{OD}^{2}}{4}\right) \cdot GrainLength_{initial}$$

$$Volume_{liquidparaffin} = 11.786\,in^{3}$$

$$Volume_{solidparaffin} := \left(\frac{\pi \cdot Grain_{OD}^{2}}{4} - \frac{\pi \cdot GrainPort_{avg}^{2}}{4}\right) \cdot GrainLength_{final}$$

$$Volume_{solidparaffin} = 10.047\,in^{3}$$

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

PercentShrinkage = 14.756