Executive Summary

This month I tested a 13.5 cm high flux PLA/$KMnO_4$ fuel core (video). The objective was to increase the O/F ratio. Ignition occurred in ~ 1.3 sec with ~ 4.2 sec of thrust. From the video, I was able to deduce the mass flow rate. As such, the O/F ratio was ~ 4.0. The L/D was 8.8 and the initial surface flux was ~ 0.24 $gm/cm^2/sec$. Unfortunately, both my pressure and thrust diagnostics failed. Also, from the test, it appears as though the L/D is the dominate parameter as opposed to the initial surface flux.

Technical Stuff

This month, to increase the O/F ratio (making it more oxidizer rich), I decreased the PLA/$KMnO_4$ high flux (HF) fuel core to 13.0 cm and 13.5 cm. Summary of tests,

- 60 ml of ~88% HTP with 2.4 ml denatured ethanol (O/F 25)
- propellant tank pressure @130 psig
- 1/2" stainless steel mist nozzle with 1.5 ml orifice
- 13.0 cm and 13.5 cm HF fuel cores with L/D 8.4 and 8.8 respectively
- edzieba PLA flow restrictor 2.0 mm thick with 4.0 mm orifice
- 1" diameter, 4.6 cm long CPVC mixing chamber
- phenolic nozzle with 6.7 mm throat diameter (L* 54.2 cm)

The 13.0 cm HF fuel core test had a brief ignition at 1.3 sec, went back to PLA/$KMnO_4$ streaming out of the nozzle, and then exploded at 2.4 sec. The chamber pressure reached ~ 46 psia before the explosion and there was no thrust data. The L/D was 8.4 and the initial surface flux (ISF) was ~ 0.25 $gm/cm^2/sec$.

In the 13.5 cm HF fuel core test, ignition occurred in ~ 1.3 sec with ~ 4.2 sec of thrust. Unfortunately, there was no pressure and thrust data. The only data was from the video which I can use to deduce the mass flow rate. As such, the O/F ratio was ~ 4.0. The L/D was 8.8 and the ISF was ~ 0.24 $gm/cm^2/sec$.

To conclude, I reached my objective of a higher O/F ratio. It appears as though the L/D is the dominate parameter in these two test. I find it hard to believe that a 0.01 $gm/cm^2/sec$ ISF can make that big of a difference. But, of course, more testing in the new year is required.