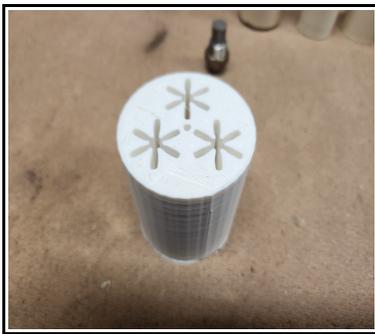


Executive Summary

This month, I worked on the class II fuel core. I printed out two 3 port 6 cm long fuel core segments and infused them with KMnO_4 . To prevent the fuel core segments from separating during burn, I screwed them together with a nylon screw. Also this month, I continued experimenting with a stainless steel motorized ball valve.

Technical Stuff

This month, I worked on the class II fuel core. I printed out two 6 cm, three port cores. Each port has the same parameter as the original high flux fuel core. I simply added two more ports. The picture on the left shows the PLA fuel core segment hot off the press. The segment is ~ 5.4 cm (2") in diameter, has a mass of ~ 127 gm, and took 16.5 hrs to print. The picture in the center is two of the PLA fuel core segments infused with KMnO_4 . The picture on the right is the two fuel core segments screwed together.



I have two concerns. First, is the infusion uniform throughout the diameter as it is in the smaller fuel core? My plan is to assemble a rocket motor and test it. If I get ignition and stable burn, it will indicate the extent of the infusion. After the test, I'll cut into the segments and examine their interior.

Second, will the fuel core stay together during the burn? I'm confident the first segment will be held in place by the walls of the casing and the pressure inside the fuel core. In previous tests, the top of the fuel core segment downstream of the spray nozzle injector did not erode much. As such, I expect the three port fuel core segment downstream of the three spray nozzle injectors to do the same.

The big concern is the second segment. The outer wall should be held in place against the casing by the pressure inside the fuel core segment. It is the center core of the second segment that may separate from the first segment if enough erosion occurs. In the class II rocket glider, I plan to burn as much fuel as possible. To prevent the second segment from separating and plugging the nozzle, I tapped out the center of the fuel cores, added a nylon screw, and screwed them together. We'll see if it works.

Also this month, I continued experimenting with the motorized ball valve. In the latest test, ignition occurred after ~ 3.5 sec and burned for ~ 2.9 sec. I stopped the opening at 0.62 sec resulting in an initial flow rate of ~ 20.4 ml/sec. I'm using a spray nozzle with a 2.0 mm orifice. It is clear in the video of the test that the HTP is washing out the ignition (i.e. the oxidizer flux is too high). Since the 20.4 ml/sec is almost the same as that using a spray nozzle with a 1.5 mm orifice, the problem may be with droplet size. In the next test I'll stop the opening at 0.6 sec. At 0.6 sec, the initial flow rate is ~ 10.5 ml/sec.

Next month, more experimenting with the motorized ball valve. Also, I'll assemble a rocket motor using the 3 port fuel core.