

## **KNER Propellant Ignition**

The only downside I've found using KNER propellant is that it's just plain hard to get ignited. While that's good for safety, it presents a challenge to a certain extent. I've found using a painted on mixture of homemade black powder greenmeal, magnesium grit and a binder, the propellant lights instantly and efficiently. I'm sure there are many variations of ignition aids that would work, I'll simply present what I'm using because it works so well.

Black powder is a combination of 75%  $\text{KNO}_3$ , 15% charcoal and 10% sulfur. I've never been able to make black powder that was any where near as fast and powerful as commercial black powder, but that really isn't required in this case.

You can also get black powder from commercial black powder motors. Take a little "C" motor and cut the paper casing off the propellant. Remove the clay nozzle and the delay plug, they will almost fall off once out of the paper casing. This black powder slug is highly compressed, and about as hard as a brick. Unusable the way it is, and dangerous to try to break it and grind it. I put the slug into a small bowl, and drizzle a little water on it, let it soak, drizzle a little more until the slug of black powder dissolves into a thick paste. Spread the paste into a thin layer on some aluminum foil, and let it dry in a warm place. Once dry you can make it into a powder with a mortar and pestle, or plastic spoon on a plate.

Start with your chemicals as finely powdered as you can get them. For safety, we won't ball mill or grind the chemicals once they are mixed together. Measure the chemicals by weight into a spark proof container. Make sure you wear personal safety gear and work outside if possible. Make small batches, no more than 50 grams at a time. Mix the chemicals with a plastic fork until the mixture looks uniform. At the end of the mixing I add 2 grams (to the 50 gram batch) of magnesium shavings. The magnesium should not be powdered, rather it should be small shavings and granules sugar sized and larger.

The magnesium probably isn't needed, but the larger magnesium particles burn slow and hot, just perfect for what we need to do. You can try finding Mg at a machine shop, or make your own from a chunk of Mg from a metal scrape yard. I purchased 3 pounds of 99.5% pure Mg from an eBay seller for about \$20, I think it will last several lifetimes. You can file the Mg, or use a rasp or coarse sand paper to make the shavings.

The binder I use is nitrocellulose lacquer. You may find it in hobby shops, but it's really easy to make. You need acetone and ping pong balls. The ping pong balls need to be the real, old fashioned nitrocellulose variety. The white balls made in China have all been real nitrocellulose that I've found. The way to tell if they are

nitrocellulose is to cut one in half and take a whiff, you'll smell camphor (sort of like menthol) if it's real nitrocellulose. Camphor is added to nitrocellulose as a plasticizer and to stabilize it.

Cut up two or three balls into thin strips, and drop them into a Pyrex container. Add one cup of acetone and cover the top to prevent evaporation. Shake, or swirl the container every few minutes, until the balls have dissolved. You can vary the viscosity of the nitrocellulose lacquer by adding more acetone to thin it out, or remove the lid to allow some acetone to evaporate. I find it works best when it's about like paint.

Three ping pong balls will make a lot of binder. So store the extra in a sealed container in a safe place. You'll likely have to add more acetone to thin it before the next use. Even with a lid on, it seems the acetone evaporates.

When ready to "paint your grains", add a tablespoon or more greenmeal to a small cup. I use a 1 cup Pyrex bowl, then add some nitrocellulose lacquer and mix it with a wood stick until smooth. Add acetone if needed to make it a thick liquid.

For small grains I've used "cotton swabs on a stick" (Q-tips) to paint the mixture onto the grains. For larger grains I use a small hobby brush or acid brush. The acetone evaporates quickly, so add more acetone as needed. You want a thin layer of solids on the grain, don't just paint them black... You may need to dab rather than stroke the mixture on the grains.

Make sure you cover all the burning surfaces of every grain. I've tried just doing the upper grains in a motor, and ignition was slow. The mixture dries quickly, but give it a half hour or so before installing the grains in a motor.

It's hard to reuse the pyro mixture once it dries and hardens. So don't mix up more than needed for the job at hand. Dispose of any leftover material in a safe place. The grains are now much more ignitable, so treat them with extra respect from this point on.

It is possible to light KNER motors with just a good igniter, but I've found performance suffers, and usually the burn profile becomes progressive because the grain ends are the last to start burning. I'm sure there are many formulas that would work as well, or better. Feel free to let me know what does or does not work.

Happy Flying!