Making Round Stars with a Star Roller

--- Steve Hubing ---

Why round stars

- Lend themselves to color changing
- Fit better in a round shell
- More aerodynamic when moving through the air giving better round symmetry.
- Better size uniformity so the stars burn out at the same time.

General Comments

- Think of star rolling as rolling a snowball to make it bigger for making a snowman.
- Star rolling with a star roller works best when there are enough stars to produce a large pile of stars in the star roller.
- A large pile of stars in the roller will be heavy and have a good cascading of the stars in the roller. This will help the stars pick up composition and grow rouander and uniformly.
- I like to work with at least 1000 stars in a batch.

Core Selection

- General considerations
  - Star compositions must have something to form around and this is called a core.
  - The rounder the core, the better.
  - Good core size uniformity helps.
  - A heavy core makes the rolling process “easier”.
- Core materials
  - Lead shot
    - Heavy and round
    - Good to be used by the beginner
Use #6, #7 ½ or #8 lead shot
Disadvantage is that the lead shot is not burned up and comes back down and could injure people on the ground.

- Millet seed
- Certain pasta like Acini De Pepe
- Molecular sieves
- Yellow mustard seed
  - This is what I use, and I recommend
  - Cheap
  - Can get at grocery stores or Amazon

Core Preparation

- Lead shot (for the beginner)
  - Start with 500 to 1000 cores
    - #6 lead shot weights about 14 gm/100 pellets
    - Clean the shot with acetone to remove any grease or oil
    - Place cores in roller and coat with fine bentonite using 50/50 alcohol/water.
    - Lead shot cores are now ready to add star composition.

- Mustard seed
  - Size and clean with a 20 mesh screen.

Selection of Solvent

- Dextrin or SGRS (soluble glutenous rice starch) bound stars
  - Water activates Dextrin and SGRS
    - Using all water will make the small stars too sticky and stick together.
  - Use a mixture of water and alcohol.
    - The alcohol doesn’t activate the Dextrin or SGRS
    - The alcohol helps the star to dry faster (less water)
    - Start with a 50/50 mixture of water/alcohol
      - This mixture helps make the small stars less sticky.
  - Can reduce the amount of alcohol as the stars get bigger.
- As the stars get bigger their tendency to stick together gets less. Therefore, you can use more water to increase the sickness, so the star composition gets picked up better and the stars grow faster.
- For large stars you can use straight water.

- **Other solvents**
  - Alcohol
  - Acetone
  - NC lacquer

**Star Compositions**

- **General considerations**
  - Heavier star compositions, like those with metals in them, tend to roll better.
  - Color compositions generally roll good.
  - Star compositions that are high in fine charcoal are often difficult to roll because the charcoal is very light and doesn’t like to be wetted with water. Willow star composition is an example of a hard to roll composition.
- The Veline star composition system comps are good star comps to roll with (see Ron Jansen’s star rolling handouts on the website for formulas).
- Glitter compositions work well.
- **Blond Streamer star composition.**
  - Potassium Nitrate 45%
  - Charcoal 29%
  - Sulfur 6%
  - Ferrotitanium 100 mesh 15%
  - Dextrin (or SGRS) 5%
  - Ball Mill the potassium nitrate, sulfur, charcoal, and dextrin in a good ball mill for about 2 hours. Then add the FerroTi
Star Rollers

- There are many types and variations of star rollers and most of them work well.

- Shape of the star rolling pan
  - Flat bottom pot
    - Generally, work okay but the flat bottom concentrates the stars in a narrow angle which may cause issues as the stars get larger.
  - Flat bottom with a curved side and narrowed opening
    - Works better than an all flat bottom
    - Modified cement mixer would be an example
  - Round bottom
    - A large mixing bowl is an example of this.
    - Works good and gives the stars a circular motion.

- Size of star rolling pan
  - The amount stars you want to roll helps determine the size of the rolling pan.
  - Generally, the bigger the rolling pan, the larger the amount of stars you should be rolling in it.
  - You want the pile of the stars in the pan to be large enough that the stars cascade and roll against each other.
  - The larger the pile of stars the easier it will be to roll the stars and the rounder and more uniform the stars will be.

- Some types of star rollers
  - Small hobby star rollers
    - These rollers generally use a 5-gallon pot or equivalent as rolling pan.
    - Good to roll stars up to about ½ inch in size. Once they get bigger than this you won’t have enough stars in the rolling pot to get good star rolling and cascading.
    - Some have of these rollers have a built-in bouncing mechanism that helps keep the stars from sticking together and grow more uniform.
  - Modified cement mixers
- These types of star rollers work well.
- At a hobby level the mixer needs to be a small one. A mixer of about 1.75 cubic ft is a good size.
- Larger cement mixers would need a large batch of stars to work well. Maybe around 20 to 50 lbs. of stars.
  - Candy coating pan
    - Generally round sides and bottoms.
    - Made for coating round candy
    - Expensive and hard to find used.
  - Rollers made with other types of pans and bowls.

- Speed of rotating star rolling pan
  - Speed of rotation of the star rolling pan does have an effect on how the stars grow and how uniform they grow.
  - Look for the star pile to be cascading down on itself to get a good idea if your rotation speed is good.
  - Too fast and the stars climb up the pan and cascade down too hard.
  - Too slow and the stars won’t cascade and may just slip in the pan.
  - When the stars get bigger, they can be fragile and may require a slower rotational speed so the stars don’t break apart.
  - A variable speed star roller is a nice feature to have, especially for the beginner.

**Screening stars for size**

- Using a screen having an opening size to size stars to what you want, is helpful and often necessary.
- There are various kinds of sizing screens and they all work.
  - Hardware cloth with openings of various sized
  - Buckets with holes drilled in the bottom
  - Sheet of aluminum or plastic with holes drilled in them and put in a frame.
- When you see your stars growing ununiformly, you can use screens to screen out the small ones and grow up to the size of the bigger ones.
Star Rolling Methods

- **Spray and Dust**
  - Spray and dust is just like it sounds.
  - Spray the rolling star pile with your solvent (alcohol/water or water) until the pile of the stars is very wet but not sticking together
  - Sprinkle on or pour on the dry star comp a little at a time until the stars will no longer pick up the star comp.
  - You want to get the stars wet just to the point of sticking together before you add dry comp.
  - Use your fingers to mix the pile as it rolls
  - Don’t let the star pile slip in the pan.
    - This can be a problem with very smooth shiny pans.
    - You may have to roughen up the star pan, so the stars get a better grip on the pan.
    - Use your spray or dry comp to give the stars some traction.
    - Getting a little scum on the pan sides can also help.
  - Try to keep the pan clean
    - A little scum in the pan is okay and helps the star not to slip.
    - Too much scum and the stars will not grow as fast or not grow uniformly because the star comp is being taken up by the scum
    - Getting the stars wet and letting them roll for a while may help to get rid of the scum.
    - If there is too much scum build up, take the stars out and clean the pan.

Toto Method

- The Toro method of star rolling involves making a slurry of your star composition with water and using that in place of wetting and dusting stars

- **General comments**
  - Grow the stars about 1-2 mm then dry
  - When done right this method produces very round stars
  - Often you don’t have to use screens at all or very little to size the stars.
  - This method is very forgiving
- You don’t need expensive alcohol
- This method can heal stars that have flaked or gotten bumpy.
- You can’t use this method to start stars from cores
- The stars should be around ¼ inch or bigger before you start using Toro.
- Stars dry faster
- May take longer to roll stars to desired size because you grow them with multiple Toro and drying sessions.
- Watch my you tube videos.
  - On YouTube do a search for Steve Hubing to find my channel
  - Here’s the first video. [https://youtu.be/a120OIbsy0c](https://youtu.be/a120OIbsy0c)

**The slurry**

- To make a slurry, take some of you star composition and add water to form a somewhat thick slurry. Think of a thin pancake batter.
- Small stars will need a thinner slurry. This is because the small stars are not heavy enough to incorporate a thick slurry.
  - Think a thin maple syrup.
- As the stars get larger, they can handle a thicker slurry.
  - Think of regular pancake batter

**Growing and drying the stars**

- Add slurry until the stars get just to the point of sticking together, then add dry star comp until the stars no longer pick up the comp.
  - When the stars are small it’s best to sprinkle on the dry star comp.
  - When the stars get bigger you can just dump in the dry star comp.
- Grow the stars about 1-2 mm and then dry them.
  - Use a caliper to measure the stars to know how big they are getting.
- Once dried you can do another rolling session
- The Toro method uses several rolling sessions to grow the stars to the desired size.
- Because you’re adding small layers of star comp, the stars will dry fast, and you can often do 3 or more rolling sessions in a day.
Priming Stars

- Most stars will require some type of prime layer so the stars will reliably take fire when the shell bursts.
- Stars that light easily (e.g. black powder-based stars) will only need a single prime layer.
  - A good prime for these types is a simple scratch mix black powder.
- Stars that are hard lighting (e.g. perchlorate-based stars) will need a step prime system.
  - Step priming means you will have multiple layers of prime applied to the star.
  - A 4-layer step prime is a good system to use:
    - 1\textsuperscript{st} step layer is made of 1/3 prime and 2/3 star comp.
    - 2\textsuperscript{nd} step layer is ½ prime and ½ star comp.
    - 3\textsuperscript{rd} step layer is 2/3 prime and 1/3 star comp.
    - Last layer is straight prime.
    - Using less layers is okay too, just try it and see how the stars light.
    - Your choice of primes.
  - Black Powder prime:
    - A simple scratch mix black powder works well for priming all but the hardest to light stars.
      - Kno3 75%, S 10%, C 15%
        - Fine powders just screened together to mix
      - It takes fire well and burns slow so get the star light.
      - May add 5% to 10 % 200 mesh magnalium to harder to light stars.
      - Ball milled black powder also works.
      - Meal D black powder is another possibility.
  - KP prime (Potassium perchlorate):
    - With or without Sulfur
      - KP 66.7%, C 17.1%, S 11.4%, dextrin 4.8%
      - KP 65%, C 30%, dextrin 5%
The sulfur version can be used to prime ammonium perchlorate stars (don’t use potassium nitrate for ammonium perchlorate stars)

The non-sulfur version can be used to prime chlorate stars (avoids the sulfur/chlorate incompatibility)

- Hot primes can also be used to light hard lighting stars
  - Pin Ball prime
  - Fence post prime
  - Monocapa prime
  - Check Ned Gorski’s site (fireworking.com) for more primes and formulas to make them.

### Drying Stars

- I usually try to dry stars outside naturally (as opposed to a drying box outside) when possible
  - Usually I will put them in the sun to dry.
    - When drying stars with thick wet layers and high charcoal content, be careful of getting the stars “driven in”. This means that the outside of the star will dry and not allow the moisture inside the star to escape.
  - Chlorate based stars should be dried in shade
  - You want to dry the stars relatively quickly and don’t allow them to sit around for hours or days wet.
  - Always dry stars outside and not in a building
  - A wind blowing on the stars will help them dry faster.
  - Without wind, put a fan on them.

- Using a drying box
  - Instead of drying outside in the sun or shade a drying box can be used.
  - A drying box should always be placed outside and away from buildings.
  - Keep the temperature 80 to 100 degrees F.
  - Use a temperature controller to regulate the heat
• Use a fan to move the air
• The box must be constructed so that dust or small particles from the stars do not drop on to the heating elements.
• It’s always possible that the stars may catch fire when using a drying box.
  • How do you know when they are dry?
    • You can’t break them when putting them between you finders and pressing hard.
    • They have a clinking sound when knocked together
    • Cut one in half with a sharp razor blade and scratch the inside.
      ▪ Best way to know if your stars are dry
      ▪ When scratching the inside there should no soft or gummy star comp.
      ▪ Always to this outside and be prepared for the star to ignite
        • Wear gloves and eye protection

If you have questions or need some help, please feel free to contact me.

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