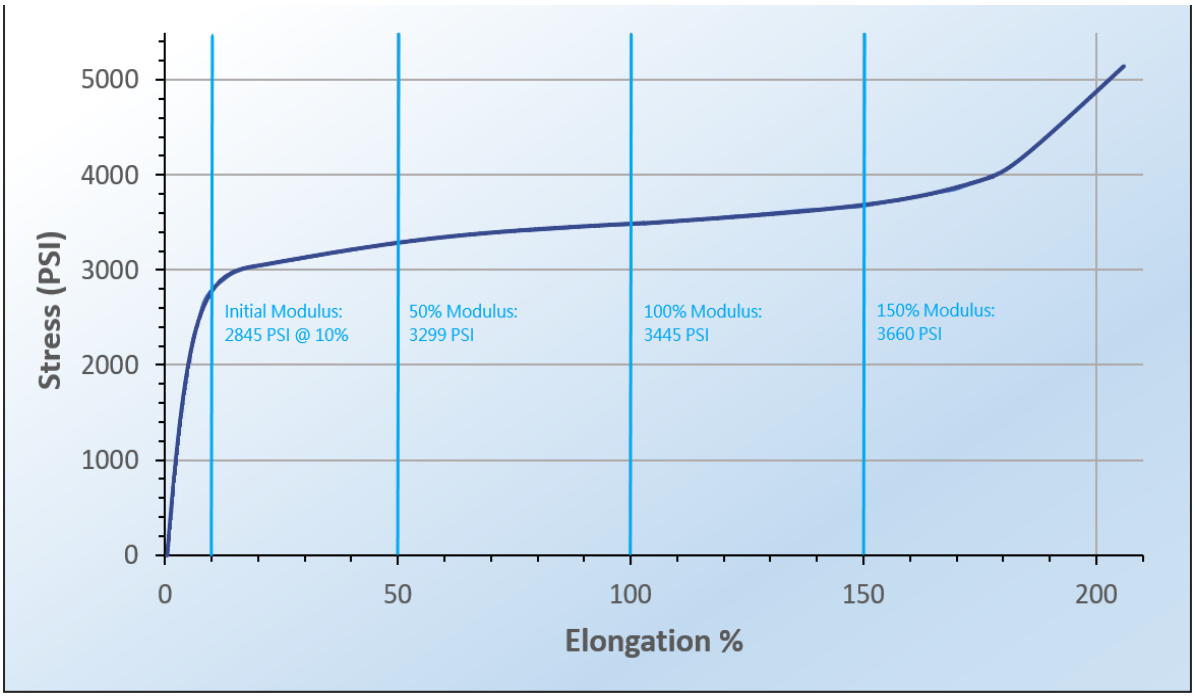
70D Polyurethane Elastomer Resin

Tech Data and How-to-Make

Physical Properties

Weight Ratio	2 Parts A to 1 Part B
Shore Hardness	73 - 75 Shore D @ 75°F
Density – lbs./ board ft.	4.95
Tensile Strength/Elongation	5150 psi @ 205% Elongation (at break)
Initial Modulus	2845 PSI @ 10%
50% Modulus	3300 PSI
100% Modulus	3445 PSI
150% Modulus	3660 PSI

70D Tensile Strength



70D How-to-Make Directions

Mixing Ratio by Weight

2 Parts A to 1 Part B

Equipment Suggested and Purpose

a) Weighing

Digital scale: weight capacity depends on the amount of material.

Capacity: 5000 to 7000 grams +- 5 grams suggested for most molding purposes.
(optional) Capacity of 1000 grams +- 1 gram suggested for detailed weighing.

b) Mixing

1) Small drill press mixer – Tabletop drill press can be fitted with a mixing unit.
2) Mixer -basket with shaft – 2 sizes ~ 1.5" basket and ~3" basket. These have the basket mixer on a shaft. The shaft fits onto the drill. A fixed-base drill/mixer is much more stable and will produce better results than a hand-held drill with mixer blade.
3) Material containers – simply use plastic buckets and metal paint cans, Gal, Qt. Use a hand can-opener to remove the rim, which is better for pouring.
4) Vacuum System -- Not required, but useful for best results to take mixed-in air out of the material before molding.

c) Degassing -- It's recommended, but not required, to degas the material right in the mixing container after it is mixed, before it is poured. The easiest way to degas is to use an independent vacuum chamber. Capacities are available to fit containers from 1 to 5 gallons from a company called "BVV". They are sold as a kit with the full setup including the vacuum pump. https://shopbvv.com/collections/vacuum-chambers

d) Molding – "Real" molds are expensive due to their precision manufacture and mass of aluminum or steel. For prototyping, we use Teflon or Silicone - coated pans from a kitchen products store. If using non-Teflon pans, use spray-on Silicone mold release.
Also plastic sheets, made from HMW polyethylene or polypropylene are good surfacing for counters. These make it easy to remove mixed urethane and can be cleaned with IPA or Acetone. One can roll or press fiber/urethane composites right onto the plastic and peel them off when cured. These plastics are temperature-resistant to about 170F.

e) Curing/warming materials – "Lab" oven: A small oven should be large enough to hold a 5-gallon can. The cost is mostly dependent on whether it is dial-controlled (analogue) or Digitally controlled. Using a thermocouple, an analogue controlled oven can be fairly temperature stable. Put a tray or piece of foil on the bottom shelf to help prevent temperature spikes. This is also a good way to collect drips.

Mixing and Molding the Polyurethane

a) Estimate the amount of material needed for each mold/pan.
   Measure the 3 dimensions of the mold in inches to determine the total cubic inches of volume. Divide this by 231 cubic inches per gallon. Estimate 4000 grams per gallon.
   (If you will be using vacuum degassing (step d), set it up before working with the materials.)

b) Weighing:

   1) Place the container you will be mixing in on the scale. Tare the scale to zero before adding Side A material.
   2) Weigh the A-Side into the container you will be mixing in.
   3) Bring the A-side container under the mixer.
   4) In a separate container that can be poured into the mixing container, weigh the amount of B-side. PLUS, an additional roughly 10% of B-side.
   5) Tare the scale so it will read zero with the material and container of B-side on the scale.
   6) Start the mixer at a speed just fast enough to form a small vortex.
   7) Pour the B-side into the mixing container. As the container empties, you can reweigh the B-side container, and the read-out will be amount of B-side added to the mix. This will enable a precise measurement of B-side.

c) Mixing

   1) Once all the B-side is added, increase the mixing speed to keep a small vortex, being careful to avoid mixing in air. Keep the mixing-blade basket completely submerged. The optimal speed will be approximately 500 rpm, using the basket style mixing blade.
   2) Mix a total of 5 minutes from the time that the Part B is completely added. At the 3 ½ to 4-minute range use a spatula or paint stick to scrape the sides of the container.
   3) Keep in mind that the full process of mixing, degassing, and pouring/molding time needs to be completed within 25 minutes.

d) Degassing -- Recommended, but not required.

   1) BEFORE WEIGHING AND MIXING A + B: Pre-stage the vacuum system by starting the vacuum pump and attaching the vacuum hose to the fitting on the container lid. Make sure the lid will seal the container and create a vacuum, then release the vacuum.
   2) After the 5-minute material mix (step c), place the container into the vacuum chamber, seal the vacuum chamber with the lid and turn on the vacuum pump.
   3) As the vacuum in the chamber forms, the material will begin to rise while bubbling and may start to foam. To keep the material in the container, turn the release valve on the lid to lower the vacuum. Once the foaming subsides, return to full vacuum. This cycle can be repeated as needed.
   4) The full degassing should take no longer than 5-7 minutes. Keep in mind that the full working time from the start of mixing is 25 minutes.

e) Mold Preparation

1) Molds should be preheated to post-curing temperatures in the lab oven before pour.

2) If using Teflon coated molds, no mold release is necessary. If using aluminum or steel molds, spray a healthy coating of mold release on the mold before preheating.

f) Pouring

1) When pouring, try to keep the container as close as possible to the mold to minimize bubble formation.

2) Very important: Pour the entire amount in one continuous stream to avoid separations and bubbles in the material. As much as possible, avoid pouring on top of curing, poured material.

g) Post Cure

1) Once the material has been poured and has gelled it can be transferred to the oven to post-cure for at least 1 hour before it can be removed from the mold. After it has been removed it can be post-cured again as desired.

2) The material can also be post cured at room temperature for at least 2 hours before removing it from the mold.

h) Demold

1) Wear heat shielding gloves when handling hot molds. Once the product has been cured so that it is tack-free on the surface, it can be removed from the mold.

2) Wear nitrile or latex gloves at all times. Use heat shielding gloves to handle the hot mold and material from the mold.

3) De-mold the part using a heat-resistant plastic or wood spatula. If in-mold wires are being used, pull the part out of the mold by gripping the wires while pushing the part from the mold with the spatula.