

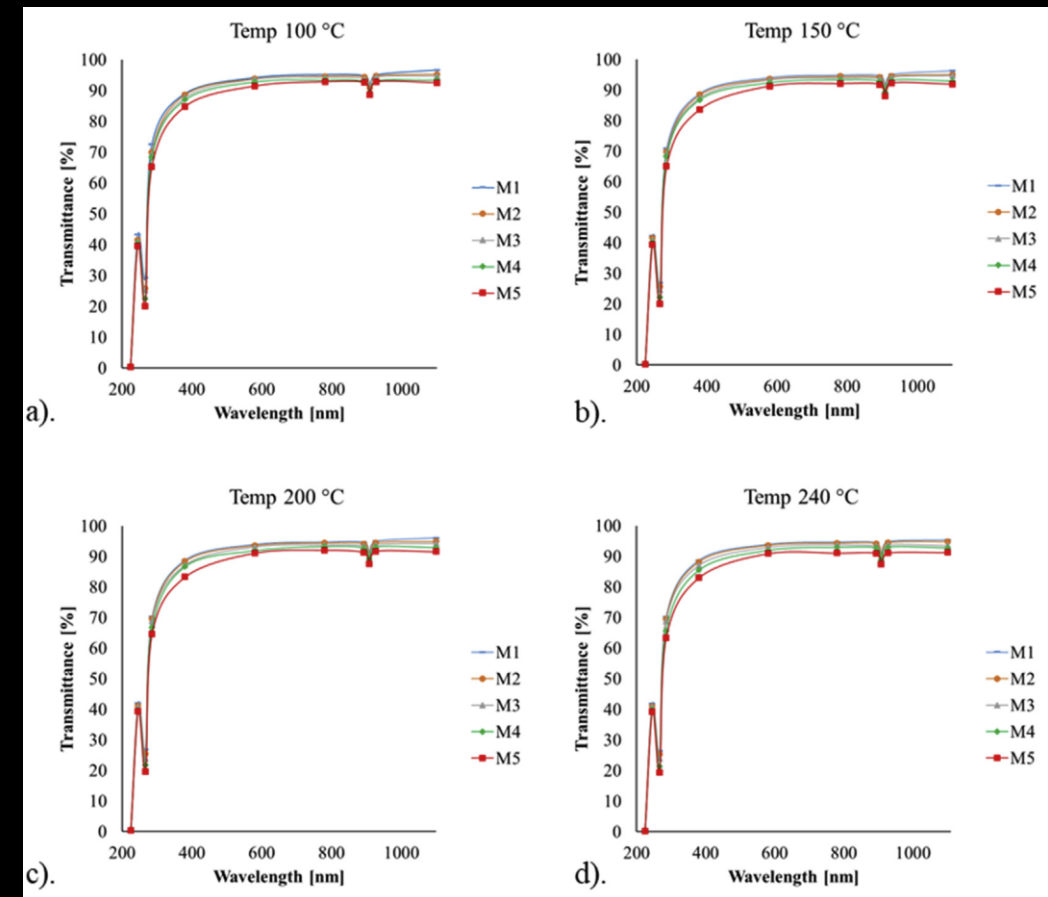


# MAPP LIGHTGUIDE STATUS

Jan 15, 2021

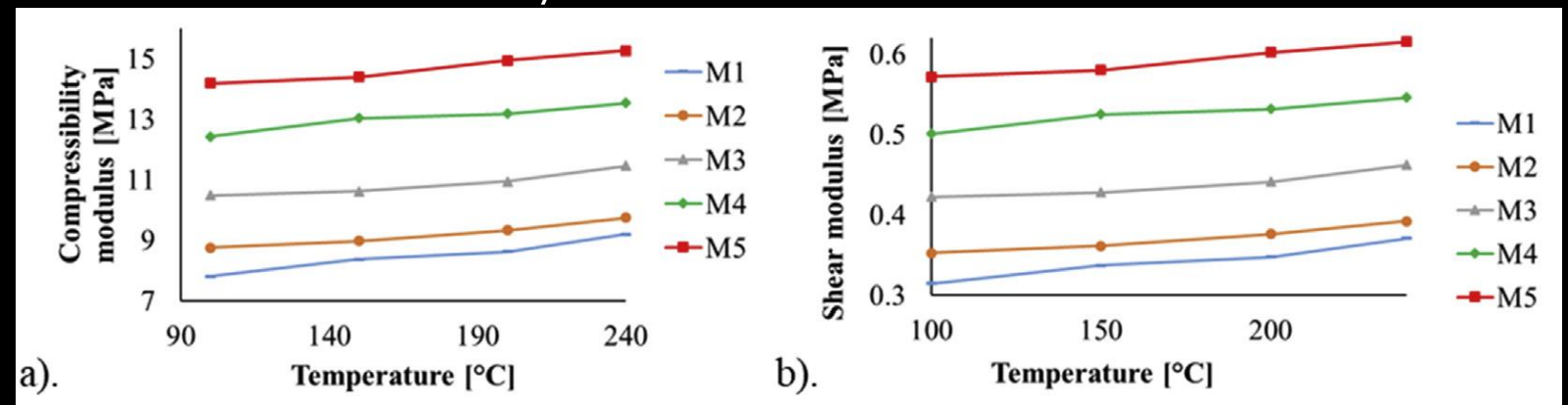
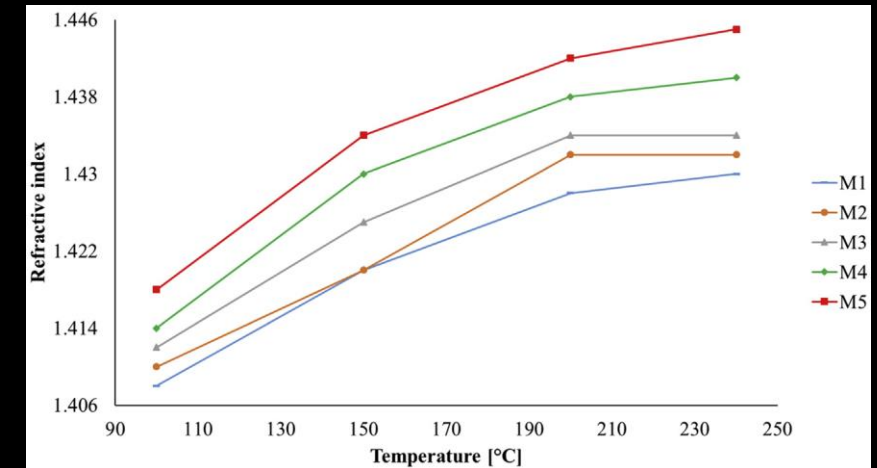
# POLYDIMETHYLSILOXANE (PDMS)

- Sylgard 184 silicone elastomer
- Wide range of curing temperatures and times
  - 48+ hours at room temperature
  - 4 hours at 65C
  - 1 hour at 100C
  - Am using 90 minutes at 82C
- Takes 7 days for mechanical properties to stabilize
- Best transmission at lower temperatures with stock 10:1 mixing ratio
- <https://doi.org/10.1016/j.heliyon.2019.e03064>



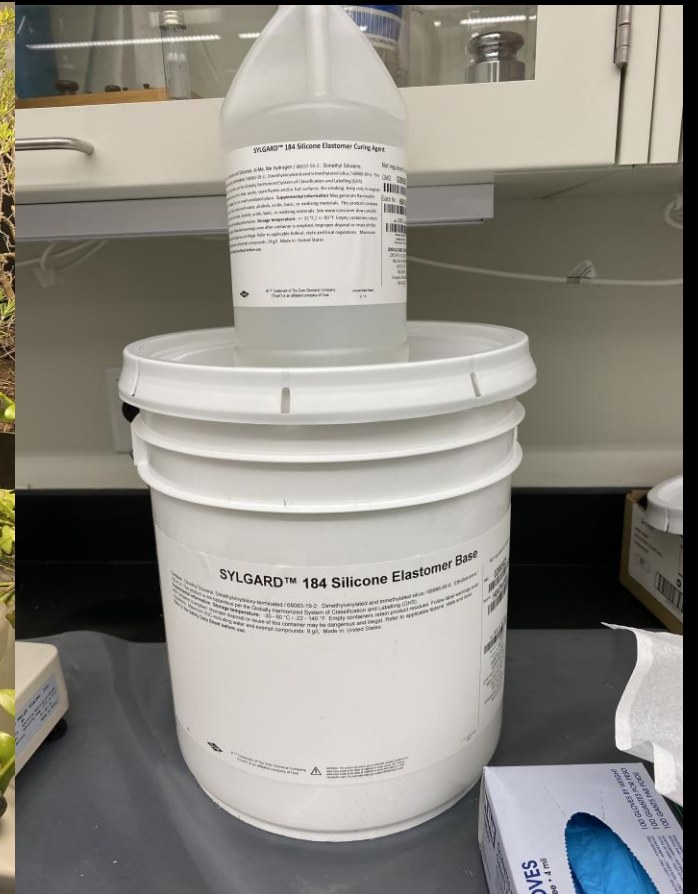
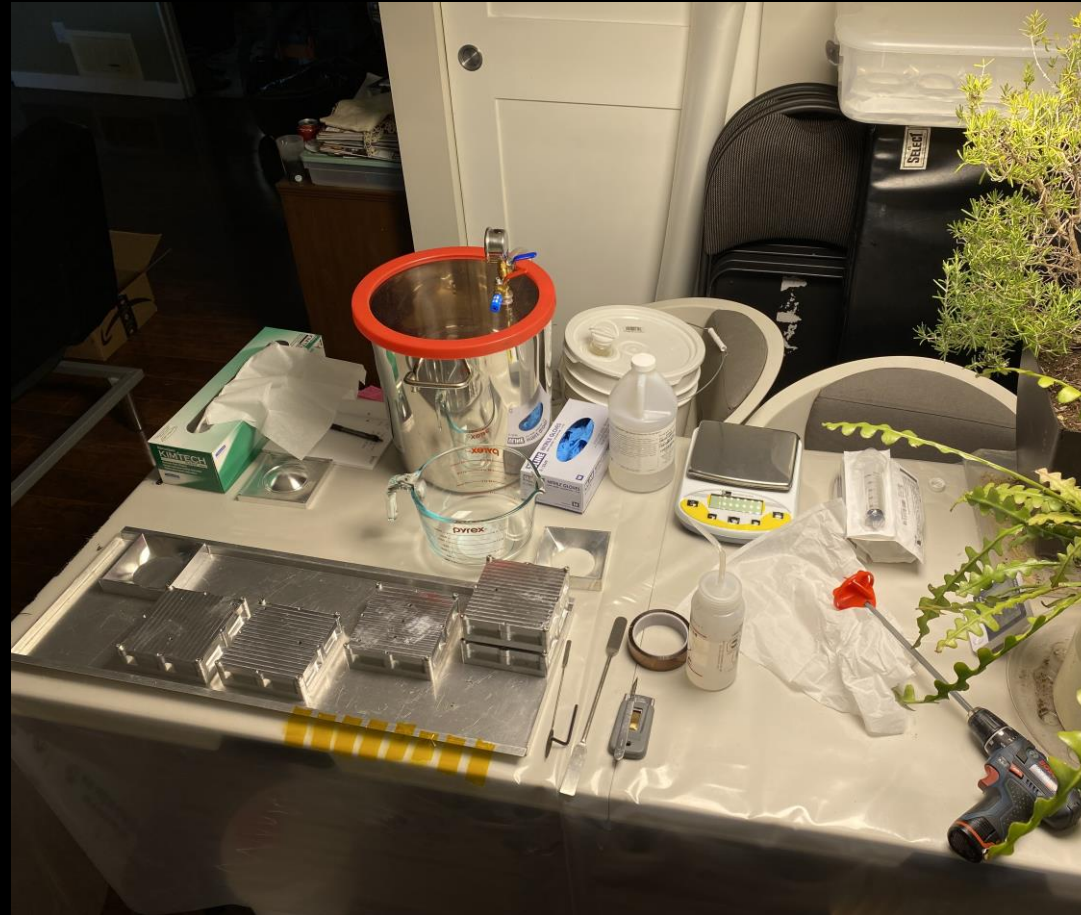
# PDMS PROPERTIES

- Refractive index varies slightly with curing temperature and catalyst ratio (nominal 1.41)
- PS scintillator RI is 1.57 (same as PMMA based scintillator)
  - borosilicate glass 1.47
  - PMMA 1.49
  - optical grease 1.47
- Increasing RI of silicone decreases its elasticity



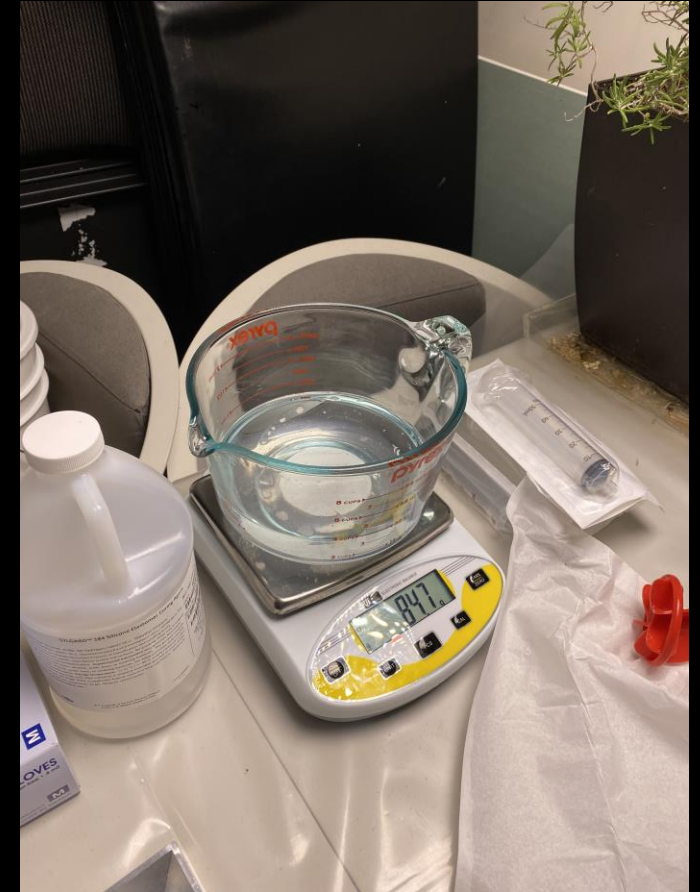
# SYLGARD 184

- Approx. \$3000/20kg pail
- Each finished light guide ~142g
- Need 400 light guides plus spares



# MIXING

- Mixed in batches of ~730g resin plus 73g catalyst
- Power mixer used
  - Material is viscous and mixing introduces large amounts of air
- Must be degassed for 1 hour



# MOLDS

- 5 aluminum molds are used for casting
- Inside machined to match measured shape of 80mm PMT on one face and 100x100mm square light guide on the other face



# INJECTION

- After degassing the PDMS is loaded into 50ml syringes and injected into the molds
- Molds are tilted at an angle with allow any trapped air bubbles to the hole at the top end of the mold
- After settling for a few minutes additional silicone is added if needed



# BAKING



- Molds are baked at an angle, excess silicone allowed to flow out
- Temperature critical, at 65C voids form but not at 80C



# RESULTS



- Silicone is easily peeled off the aluminum
- Success rate 90+%
- Worst cases missing corner or small bubbles present