Personal Project

Weighted Bracelet

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Date: 1/7/2025 - Present

Introduction:

As a personal project, I am designing weighted bracelets for the purpose of reducing tremors for individuals with parkinsons. In addition to this, I am also planning to market it towards the gym community as a passive form of weight training. This process includes working with different metals, polymers and plastics to mold individual beads to achieve a certain weight. Ideally this weight will be around 0.25-0.50 lbs per bracelet with a cost of production no more than $10-$20 per bracelet.

Initial Conditions:

- Must be skin safe
- Must weigh designated amount (0.25 lbs, 0.5lbs, etc)
- String on bracelet must be durable and easily replaceable
- For wrist, each bead must be 15mm-25mm
- For ankle, 25mm-35mm

Material Properties:

Different materials were considered for adding weight to each individual bead. While polymers, liquids and plastics were consdiered, metals were chosen for its high density and relatively low cost/sourcing. All beads will have an external coat to prevent direct contact.

Type of Metal:	Density: (g/cm^3)	Non-toxic/Skinsafe?	Price per lb: (to buy powder form)	Easy to source:
Copper	8.94	Yes, unless inhaled	$20	Yes
Tungsten	19.6	Yes, unless inhaled	$70	Yes
Lead	11.34	NO, MAJOR TOXIC METAL	N/A	N/A
Tungsten Carbide (often in medical devices)	15.63	Yes, unless inhaled	N/A	No

Molding:
Forms of Molding:

- **Injection:** This is very good for mass production and accuracy, but machines are tens of thousands of dollars and impractical for prototyping. Not ideal for the current situation.
- **Vacuum:** Cheaper alternative with machines ranging from hundreds to thousands. Could be a potential investment for future production.
- **Conventional:** Using 3-d prints to manually mold parts. Most ideal as there is no investment

Materials for Molding:

Mateiral	Skinsafe?	Application	Flow Property/Viscosity	Melting Point
TPE	Yes	Cosumer goods, Medical Devices		340 F
TPU	Yes	3d printing, medical devices		212 F
COPE	Yes	Cables, tubes		
Silicon Rubber	Yes	Medical, Lokai uses them		572 F

Viscosity Ratio with Metals

Type of Metal:	Molding Material:	Maximum Ratio For Proper Flow in Molds:
Copper	Silicone Rubber	1:1
Tungsten	Silicone Rubber	3:2
Lead	N/A	
Tungsten Carbide (often in medical devices)	N/A	

Initial 3-D print:

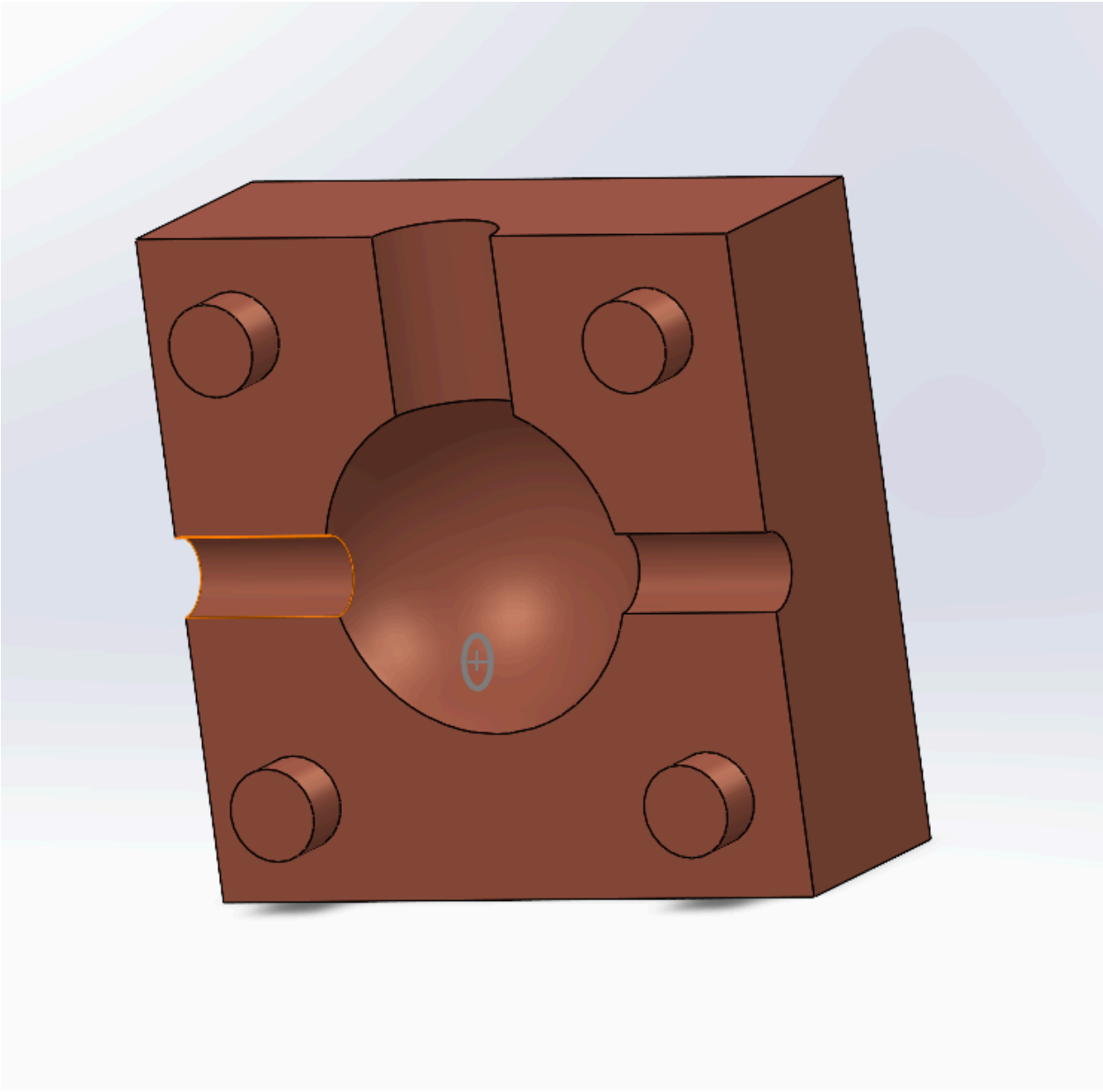

Figure 1: Initial Design for the mold

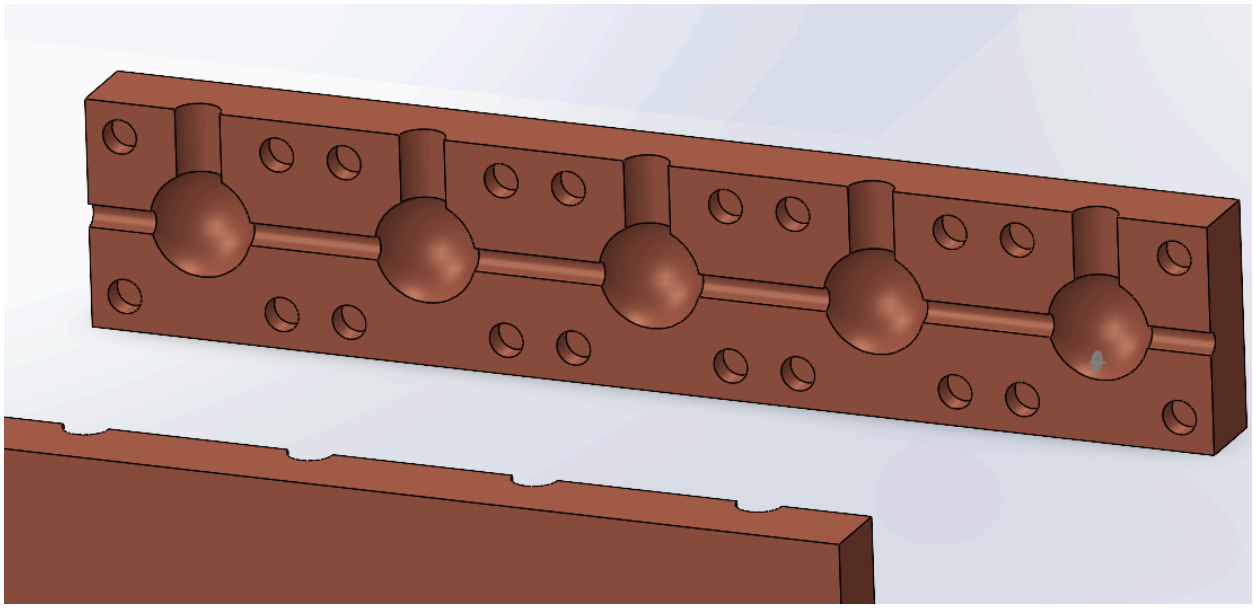

Figure 2: Mold for multiple beads

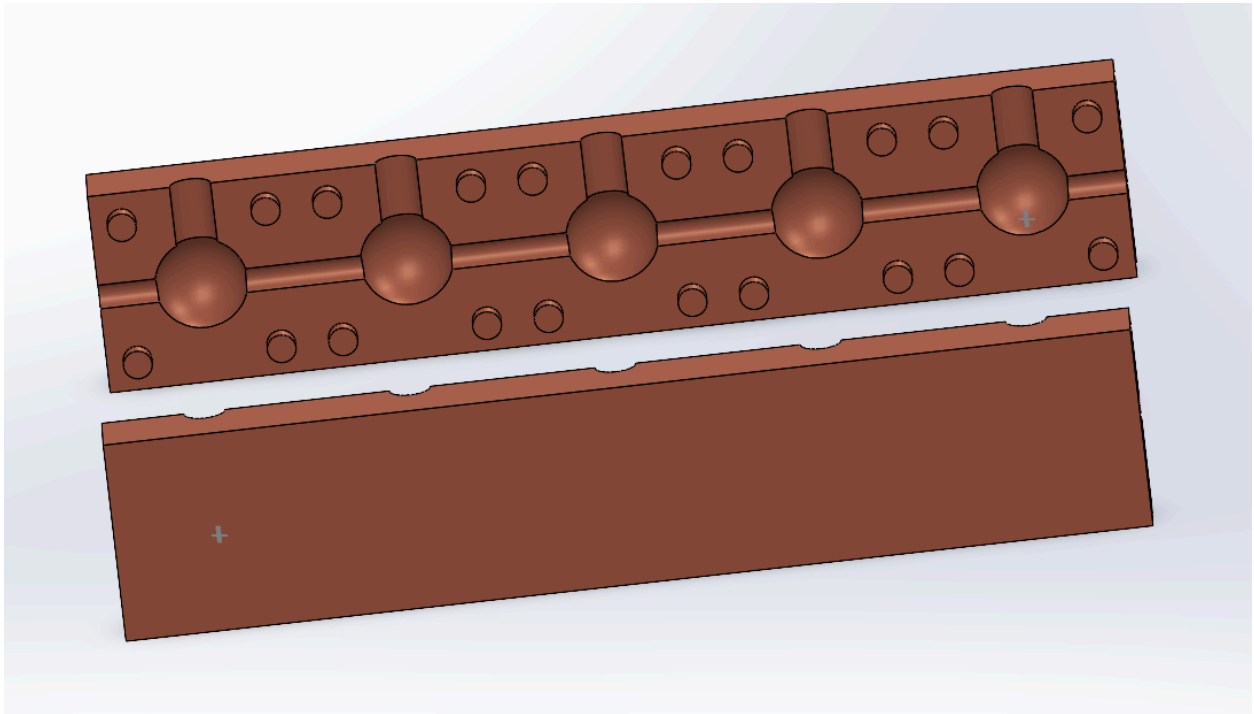

Figure 3: Other side

Testing:

Type of Metal:	Molding Material:	Bead Diameter:	Individual Weight:	Bracelet Weight (20):
Copper	Silicone Rubber	5.08 mm	2 g	36 g (less than 0.25 lbs)
Tungsten	Silicone Rubber	5.08 mm	4 g (ratio was 1:1)	70 g (less than 0.25 lbs)
Copper	PLA Shell	15.24 mm	7.8 g	156 g (>0.25 lbs)
Tungsten	PLA Shell	7.62 mm	8.2 g	164 g

Protype Outcomes:

Figure 4: Copper Beads (36g)

Figure 5: Tungsten Beads (74g)

Sources:

Density of Different Mateirals:
https://www.wermac.org/materials/density_of_metal.html