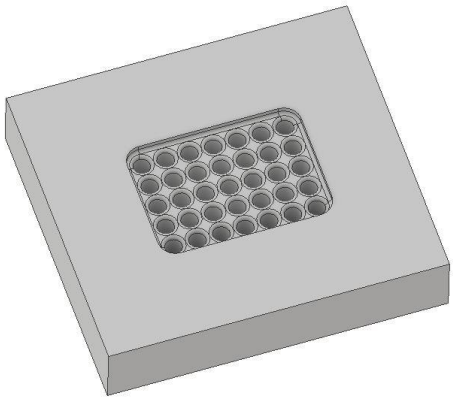
Progress update: Dry electrodes

Patricija Burgar – 5.4.2022

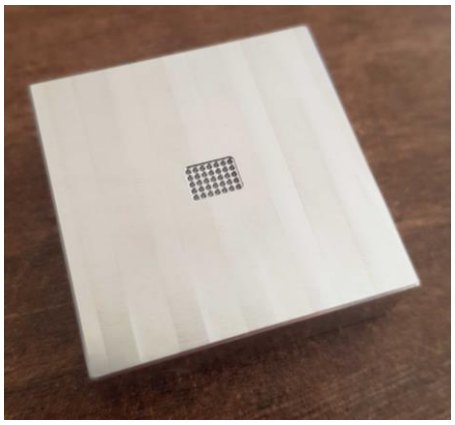
Mold design

The aluminum mold shown below was made by micro milling. The dimensions of the electrodes molded in this mold will be 4mm x 5mm. The aspect ratio of the pins is 1:3 (0.5mm x 1.5mm) and their tips are rounded which results in more durable pins. Densely placed pins contribute to a larger contact area and good conformity to the skin.

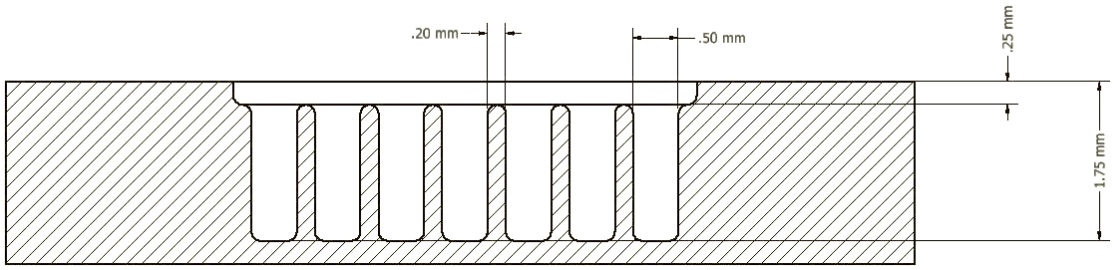
A)



B)



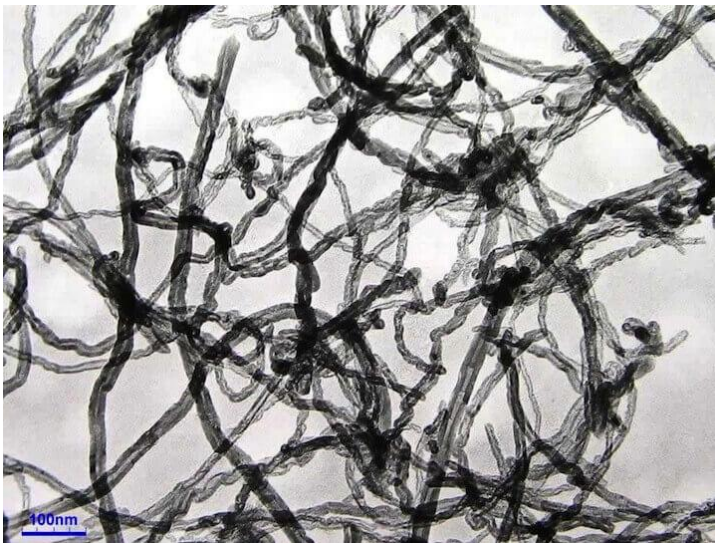
C)



1. *(A) CAD model of the mold, (B) fabricated aluminum mold, (C) and a technical drawing of the mold with dimensions.*

Composite

The electrode will be made by mixing multi-walled carbon nanotubes (MWCNT) with polydimethylsiloxane (PDMS). MWCNT were chosen based on their excellent electrical and mechanical properties. Additionally, CNT dispersed in polymer are tangled randomly, which ensures good conductivity even when the polymer is bent or stretched. This makes them suitable for our application.



2. *SEM image of multi-walled carbon nanotubes.*

Plan of fabrication:

Due to van der Waals forces between CNT the main challenge of electrode fabrication is achieving uniform dispersion of CNT within the PDMS. To obtain good dispersion, CNT and PDMS base will be mixed by using chloroform as a common solvent. The materials will first be dispersed separately in chloroform by sonication and later mixed together. Next, the chloroform will be evaporated and curing agent added to the mixture. After degassing, the composite will be molded in a preprepared mold and cured in the oven.

Mass fraction of CNT in the final composite for the first set of electrodes will be 4.5 wt%.