BITNG LAB UPDATE

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Date 7/29/2021

Progress from last week

- Shriner's Project:
  - Strain sensor
    - Graphene and carbon black ink

- Shinjae Firmware:
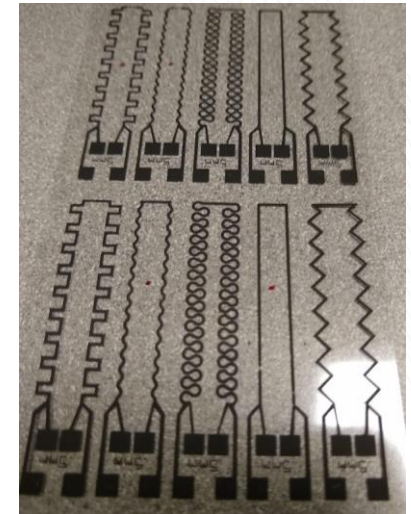 - ~~ADS1299~~
  - ~~ADS1292~~

SHRINER'S PROJECT

Screen printing: Strain Sensors

- Carbon Black
  - $\Delta R/R \% = 2.72 \%$

- Graphene
  - $\Delta R/R \% = 4.4 \%$

- Hybrid mixture: CB w/ AgNP
  - $\Delta R/R \% = 4.62 \%$

- Goal:
  - Increase $\Delta R/R \%$

- Next Steps:
  - Going to research different inks that have a larger resistance change due to bending
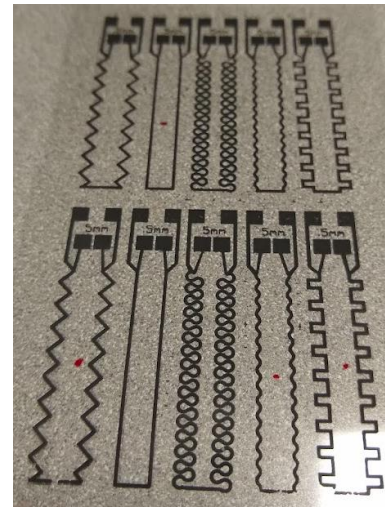
Carbon Black   Graphene

Reference: "Highly sensitive screen printed strain sensors on flexible substrates via ink composition optimization" 2019

Strain Sensor: Multi-Layer Ink

- Possible solutions:
  - Multiple layers of ink deposition
    - Top layer = AgNP (low resistance)
    - Bottom layer = CB or Graphene (high resistance)

- Micro cracks are produced in the AgNP layer
  - Micro cracks create disconnections in AgNP
  - Current flows through high resistivity layer
  - Produces a higher $\Delta R/R$

Reference: "Printability of the Screen-Printed Strain Sensor with Carbon Black ⁄ Silver Paste for Sensitive Wearable Electronics" 2020

AgNP on top

CB & Graphene on bottom

Georgia Tech
CREATING THE NEXT
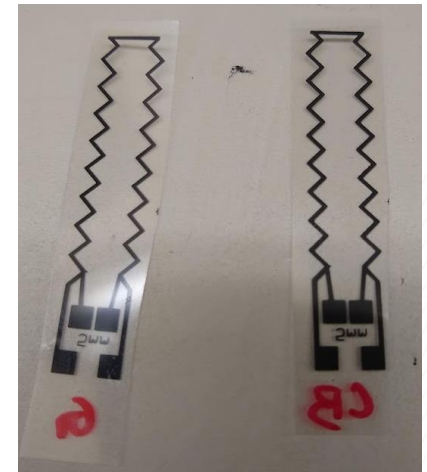
Strain Sensor Comparison

Manufacturing	Ink	$\Delta R/R$	Substrate
Commercial	Proprietary	89%	Proprietary
Drop Casting	AgNW	< 1%	PET
Screen Printing	AgNP	3.16%	PET
	Graphene	4.4%	PET
	CB	2.73%	PET
	CB + AgNP Mixture	4.62%	PET
	AgNP on Top Graphene on Bottom	8.89%	PET
	AgNP on Top CB on Bottom	10.74%	PET
	AgNP on Top CB on Bottom	*52,214%	TPU
	AgNP	*151,063%	TPU

Strain Sensor: Next Steps

- Screen printing
  - Top: AgNP
  - Bottom: CB
  - Substrate: stiffer (Too much strain with TPU)

- Goal:
  - Micro-strain + Strain

Firmware Development

- ADS1299
  - Initial firmware driver finished
  - Need hardware board to verify firmware

- ADS1292
  - Initial firmware driver finished
  - Need hardware board to verify firmware

PATH FORWARD

Path forward (7/26/21 – 8/02/21)

- Shriner's Project:
  - Strain sensor
    - Explore more sensitive inks

- Shinjae Firmware:
  - ADS1299
    - Test with hardware to verify firmware
  - ADS1292
    - Test with hardware to verify firmware

APPENDIX