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Water-based Electrically Conductive Ink from Carbon Nanomaterials

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Hypothesis

A stable, aqueous, carbon-nanomaterial (CNM) based ink can be prepared with the aid of surfactants.

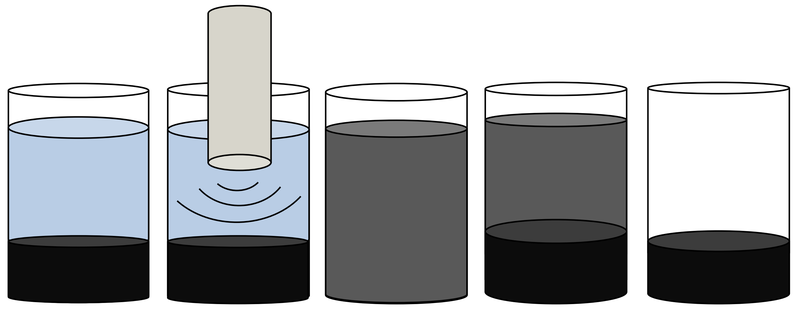
Background and Significance

- Electrically conductive ink applications include transparent electrodes, RFID tags, and inkjet printed circuits.[1]
- Current inks on the market are typically made with metal nanoparticles in solution.[2]
- Carbon nanomaterial based inks are gaining popularity due to their relative inertness, cost, and abundance.[3]

Materials

- Surfactants used in this project included Graphene Oxide (GO), Graphene Oxide predominately -COOH (GO-COOH), and Sodium Dodecyl Sulfate (SDS).
- Carbon nanomaterials used in this project included Single-Walled Carbon Nanotubes predominately -OH (SWNTs-OH), Multi-Walled Carbon Nanotubes predominately –COOH (MWNTs-COOH), and Carbon Nanofibers/Carbon Black.

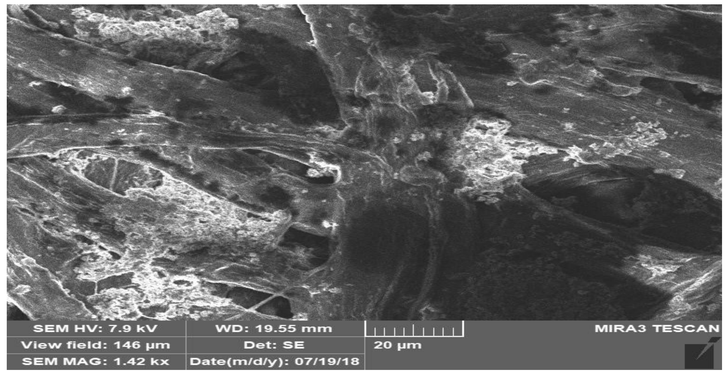
Procedure



- Place 20 mg of CNTs in 20 mL of de-ionized water
- Add surfactant increasing the ratio of CNM:surfactant from 1:1 through 1:16
- Sonificate samples for 30 min at 150 watts
- Centrifuge samples for 30 min at 4,000 rpm
- Use a pipette to remove the supernatant leaving only the precipitate at the bottom of the centrifuge tubes.

Results

Surfactant	CNM	Stable suspension
GO	MWNTs	No
	SWNTs	No
	CNFs/ Carbon Black	No
GO-COOH	MWNTs	No
	SWNTs	No
	CNFs/ Carbon Black	No
SDS	MWNTs	Yes
	SWNTs	TBD
	CNFs/ Carbon Black	TBD



Conclusion

Graphene Oxide was insufficient as a surfactant in suspending the CNMs. SDS provided stable suspensions with the optimum ratio of MWNTs:SDS found to be 1:10. Prior to and exceeding that ratio yielded increasing amounts of precipitate.

Acknowledgements

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References

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