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Effect of plasticizer on the sensing performance of PVP/CB composite

Semester Project

(Section: microengineering, material science)

In the era of the internet of things (IoT), the demand for low power and low-cost sensors has been growing. Mainly there has been a growing interest in environmental sensors capable of detecting volatile organic compounds (VOCs). Such sensors are of interest for applications in health care and environmental monitoring. Chemiresistive sensors based on polymer nanocomposites (PNCs) are a suitable class of materials for detecting VOCs. PNCs are low cost, simple to process and operate at room temperature hence low power consumption. Therefore such sensors are a suitable candidate for application in IoT.

To fabricate PNC sensors, we use drop-on-demand inkjet-printing (DOD IJP), which is an additive manufacturing technique that allows us to pattern the functional material onto the substrate digitally. We formulate inkjet-printable inks containing the PNC of interest, deposit it onto the substrate and subsequently study the sensing behavior of the printed film.

In this project, we aim to study the sensing performance of a PNC containing polyvinylpyrrolidone (PVP) as the polymeric matrix with carbon black (CB) filler. We are mainly interested in understanding the effect of the addition of a plasticizer on the sensing performance of the composite. Adding a plasticizer to a polymer lowers its glass transition temperature, which has a direct effect on the dynamic of sensor response. Inks will be printed using a Microfab inkjet printer and the sensors will be tested under different VOCs, such as acetone and ethanol.

Work description:

- Formulating inks containing a polymer, nanoparticle, and plasticizer
- Using drop-on-demand inkjet printer to fabricate sensors
- Study the sensor response upon exposure to different volatile organic compounds, e.g., ethanol and acetone.

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