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Soluble Polyaniline for a State of Health Sensor

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A state of health sensor has been developed to protect the contents of a three-dimensional container. The sensor must be able to detect multiple stimuli as well as have the ability to be easily applied to the container by casting or spraying onto large area surfaces. The sensor must also be relatively robust and environmentally stable. High conductivity soluble polyaniline was synthesized to meet these needs and tested in a variety of environments.

Polyaniline was first doped with dodecylbenzene sulfonic acid (DBSA) via emulsion polymerization so that it remained soluble in toluene. The oil in water emulsion was tailored for the desired morphology of the polyaniline particles. The synthesis was optimized so that conductivity would be 1 S/cm or higher. The ratio of monomer to dopant and also monomer to oxidant both greatly affected the final conductivity of the material. The final conductivity determines the sensor efficiency.

Thin films of polyaniline-DBSA were subjected to various chemicals via a microfluidic device and also localized heat. The surface area of perturbation was determined between electrodes for a measurable sensor response. Additionally, blends of doped polyaniline with polymers such as polystyrene were investigated to make the sensor more environmentally stable.

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