LOCALIZING CHEMICAL AND BIOLOGICAL THREAT DETECTION

Colorimetric/electrical Sensing Of Chemical Warfare Agent Surrogates With Polydiacetylenes

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Colorimetric sensing arrays are commonly investigated in the chemical agent sensing realm but suffer from either low sensitivity, slow response time, or the logistics of multiple material/chemical types needed, some of which may be hazardous. Because of this, interests exists in the generation of improved material design for defense purposes. Diacetylene (DA) monomers composed of a functionalizable headgroup and an aliphatic tail containing a pair of neighboring C≡C units can be polymerized into corresponding polydiacetylenes (PDAs), which have a visibly blue color. Exposure to chemical liquids/vapors can result in disruption of the long-order structure of PDAs caused by intramolecular interactions between neighboring headgroups, and this in turn changes 1) the visible color to red and 2) the semiconductivity of the material. Extent and reversibility of the color change is dependent on the type of headgroup, length of DA chain, and the source/type of stimulus. Our interest lies in utilizing an array of these materials for developing a novel design platform for identifying the classification, and ideally identity, of chemical warfare agent (CWA) surrogates (organophosphates vs mustards) via the quantitative changes seen in both the colorimetric and electrical responses. These responses are through the detailed red-green-blue (RGB) changes and electrochemical impedance spectroscopy changes (EIS), respectively.

In this talk, the design and synthesis of a select group of PDAs will be discussed, along with their integration into polymer matrix materials. Furthermore, details on the CWA surrogate exposure, respective colorimetric/EIS characterization, and principle component analysis (PCA) efforts will be communicated.

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