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Detection of Explosive Materials¹

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High explosives present a challenge for detection methods because of their range of physical properties, which range from volatile liquids to nonvolatile solids. They share the common feature of possessing both oxidizing and reducing chemical properties within a single molecule or an intimate chemical mixture. Our research group has been focused on the synthesis of new luminescent polymers, which undergo electron transfer quenching by a variety of organic high explosives, such as TNT, RDX, and PETN. The application to imaging trace explosive particle residues will be described. Density functional calculations show an excellent correlation between the sensor response and the lowest unoccupied molecular orbital of the explosive analyte. For volatile high explosives, such as organic peroxides (e.g. TATP), vapor sensors based on chemically sensitive transistors containing different metal phthalocyanines have been explored. The mechanism of current response in these films has been shown to be a result of surface Lewis acid-base chemistry or redox catalysis at the metal centers. The link between surface chemistry and electronic response has led to a simple peroxide specific vapor sensor array.

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