'Sensing' danger

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European researchers developed a novel gas sensor capable of detecting trace amounts of dangerous explosives with minimal false alarms. The technology should be important to a variety of gas separation and detection applications.

The growing threat of international terrorism highlights the need to develop highly sensitive and accurate ‘smart’ sensors to detect dangerous gases, in particular nitrogenous ring-shaped compounds found in standard TNT (2,4-dinitrotoluene, 1,3-dinitrobenzene or 2,4-TNT) explosives.

European researchers initiated the DETEX project to do just that. They sought to develop a system capable of detecting trace amounts of dangerous materials and simultaneously generate fewer false alarms.

Using an amplifying fluorescent polymer (AFP) was determined to be the best way to produce highly sensitive detection. Scientists integrated the AFP with a molecularly imprinted polymer (MIP), a highly selective sensing material.

AFPs are fluorescent sensory materials that produce signal gain or an amplified response when interacting with substances. MIPs are polymers that are tailor-made to form binding sites for specific molecules (e.g. a nitrogenous ring-shaped compound) with relatively high specificity at a low cost – sort of like the lock in which a specific key fits.

DETEX investigators designed and synthesized a variety of MIPs with the goal of pre-concentrating vapors prior to detection followed by selective binding to aromatic nitrogenous compounds found in TNT.

In addition, they synthesized AFPs with stability at high temperatures and in destructive chemical environments. Following system design and integration, scientists characterized the performance in terms of the above as well as reproducibility and response time. They also analysed substances that could produce false alarms to further optimize design.

DETEX thus delivered a novel chemosensor for explosives or drugs capable of pre-concentrating and filtering vapor molecules prior to detection. The system demonstrated excellent sensitivity and selectivity at a low cost and the technology should be beneficial to numerous other gas-sensing applications.

Provided by CORDIS