Development of a Miniature Calorimeter for Identification and Detection of Explosives and Other Energetic Compounds

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ABSTRACT

The development of a next-generation system capable of providing rapid, portable, and inexpensive detection of explosives and energetic compounds is critically needed to offer an enhanced level of protection against current and future threats to homeland security, as well as satisfying a wide range of applications in the fields of forensic analysis, emergency response, drug development, and industrial hazards analysis. Calorimetric techniques have been largely overlooked in efforts to develop advanced chemical analysis technology, largely because of the limitations associated with the physical size of the instruments and the relatively long timescales (> 30 min) required to obtain a result. This miniaturized calorimeter circumvents these limitations, thereby creating a first-of-its-kind system allowing thermal analysis to be performed in a portable format that can be configured for use in a variety of field operations with a significantly reduced response time (~2 min). Unlike current explosives detectors, this system is based on calorimetric techniques that are inherently capable of providing direct measurements of energy release potential and therefore do not depend on prior knowledge of familiar compounds.