

Portable Mass Spectrometry for Post-Detonation Nuclear Forensics

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Radiological Dispersal Devices (RDDs, aka dirty bombs) are composed of two components, a conventional explosive such as TNT, RDX, or black powder and a radionuclide such as Cesium-137, Strontium-90, or Cobalt-60. The application of post-detonation debris analysis of RDDs was studied for analysis by three parts of an ideal portable mass spectrometer. First, ambient ionization methods including LDI, DESI, and DART were applied to the study of surfaces sampled with both inorganic and organic species for simultaneous analysis. Rapid sample filtration using Differential Mobility Spectrometry was studied both in simulation and experimentally to demonstrate filtration of isobaric species as well as atomic ions. Finally, an ion trap mass spectrometer using digital frequency scanning methods was investigated for the potential low power, high resolution metrics necessary for isotopic analysis. Results presented suggest feasibility of a specialized mass spectrometer designed for rapid analysis of elemental and organic constituents in a fieldable package by thoughtful consideration of these operational metrics.