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Article *in* Instrumentation Science & Technology · January 2012

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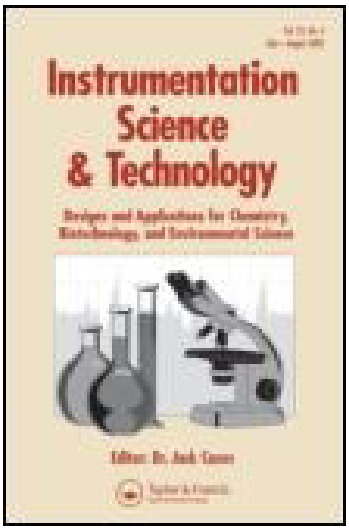

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DEVELOPMENT OF AN ION MOBILITY SPECTROMETER FOR DETECTION OF EXPLOSIVES

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Accepted author version posted online: 22 Aug 2012.Published online: 08 Feb 2013.

To cite this article: N. Sivakumar , M. Joseph , P. Manoravi , P. R. Vasudeva Rao & Baldev Raj (2013) DEVELOPMENT OF AN ION MOBILITY SPECTROMETER FOR DETECTION OF EXPLOSIVES, Instrumentation Science & Technology, 41:1, 96-108, DOI: 10.1080/10739149.2012.721109

To link to this article: http://dx.doi.org/10.1080/10739149.2012.721109

Instrumentation Science and Technology, 41:96–108, 2013

ISSN: 1073-9149 print/1525-6030 online
DOI: 10.1080/10739149.2012.721109

DEVELOPMENT OF AN ION MOBILITY SPECTROMETER FOR DETECTION OF EXPLOSIVES

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☐ *An ion mobility spectrometer (IMS) is developed for use as an analytical tool and, in particular, for the detection of species used as explosives. From the initial design based on the literature, we have, through several optimization studies, reached a configuration that provides the desired sensitivity with adequate resolution. Results obtained with the optimized geometry are presented in this article. The sensitivity of the instrument is about 10 ng for 2,4,6-trinitrotoluene (TNT) and Royal Demolition Explosive or cyclotrimethylene trinitramine (RDX) and about 50 ng for pentaerythritol tetranitrate (PETN). These explosives are detected as clearly resolved features.*

Keywords explosives, ion mobility spectrometer, PETN, TDX, TNT

INTRODUCTION

With the increasing concern over terrorism, several types of detectors for explosives are being developed.[1,2] Ion mobility spectrometry (IMS) is a widely used technique to detect explosives and chemical warfare agents,[3] and for environmental and industrial analysis and assessments.[4] Several studies have also coupled mass spectrometers to ion mobility spectrometers for definitive mass identification.[5,6] Even though mass spectrometer–based detectors for explosives are reported, they are not convenient for field applications because mass spectrometers generally operate in a vacuum of better than 10^{-4} Pa corresponding to collision-free motion of the ions. The IMS operates at a pressure of ~1 bar, and the ion motion is collisional. We have developed an ion mobility spectrometer

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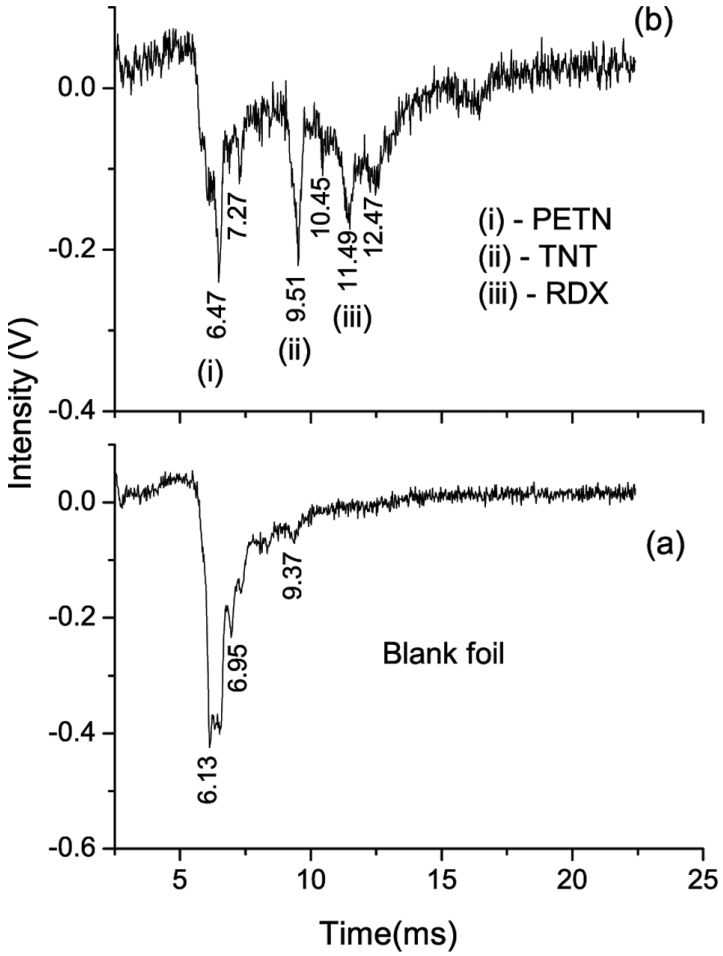

FIGURE 10 Mobility spectra for blank foil and for a mixture of TNT (10 ng) + RDX (10 ng) + PETN (50 ng). Experimental conditions: DC = –4.5 kV; high = –4505 V; low = –3750 V; gain = 1e9 V/A; pulse duration = 1.5 msec; carrier gas: air (~0.5 L/min); drift gas: com. N_2 (~0.5 L/min).

CONCLUSION

Our studies with ion mobility spectrometry have progressed through different versions of the spectrometer cell, and we have reached a configuration providing good sensitivity with adequate resolution. TNT and RDX are detected to less than 1 ppb by volume levels in the vapor mode. In the particulate mode 10 ng in mass of TNT and RDX and 50 ng of PETN are detected as clearly resolved features.

ACKNOWLEDGMENT

The authors are thankful to Electronics Corporation to India Limited Hyderabad, and Central Scientific Instruments Organisation, Chandigarh, for their involvement in the technical discussions, and Office of the

Principal Scientific Adviser to the Government of India, New Delhi, for their motivation and support of this work.

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