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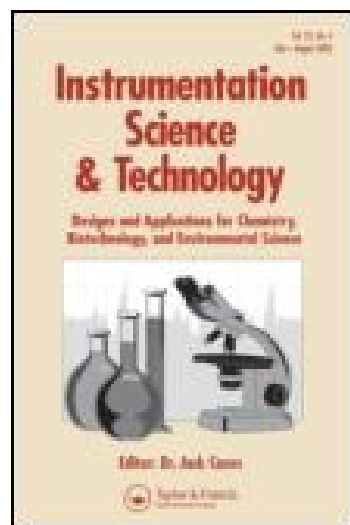
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### DEVELOPMENT OF AN ION MOBILITY SPECTROMETER FOR DETECTION OF EXPLOSIVES

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## DEVELOPMENT OF AN ION MOBILITY SPECTROMETER FOR DETECTION OF EXPLOSIVES

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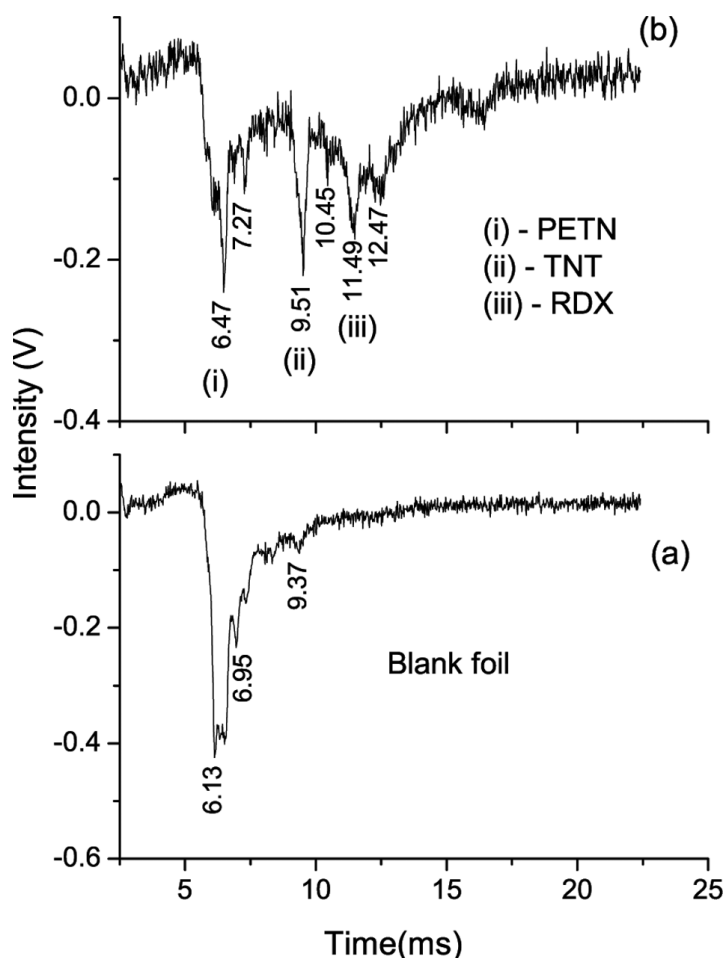
□ *An ion mobility spectrometer (IMS) is developed for use as an analytical tool and, in particular, for the detection of species used as explosives. From the initial design based on the literature, we have, through several optimization studies, reached a configuration that provides the desired sensitivity 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.<sup>[1,2]</sup> Ion mobility spectrometry (IMS) is a widely used technique to detect explosives and chemical warfare agents,<sup>[3]</sup> and for environmental and industrial analysis and assessments.<sup>[4]</sup> Several studies have also coupled mass spectrometers to ion mobility spectrometers for definitive mass identification.<sup>[5,6]</sup> 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  $\sim 1$  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 ( $\sim 0.5$  L/min); drift gas: com.  $N_2$  ( $\sim 0.5$  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.

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