AHURA

Rapid Explosive Detection Using

FirstDefender™

THE FIRST TOOL OF THE FIRST RESPONDER

Introduction

Rapid and accurate explosive detection is one of the central tasks of homeland security. The extremely large volume of passengers entering airport terminals, city transit systems, and border entry points requires detection systems that have the capabilities to reliably and efficiently screen potentially dangerous packages and containers.

Currently, standard transmission X-ray systems are used to monitor the images of various objects in packages. More advanced X-ray systems use effective atomic number Zeff and density to separate explosive materials from innocuous materials. Due to intrinsic selectivity limitations, these systems very often are triggered by common innocuous materials such as chocolate and plastics. In the meantime, non-nitrates based explosives, such as acetone peroxide (TATP) and HMDT, will not be detected by currently installed X-ray or neutron systems. Robust and handheld detection systems that have the capability to rapidly and accurately identify various explosives and their precursors are needed to supplement these technologies.

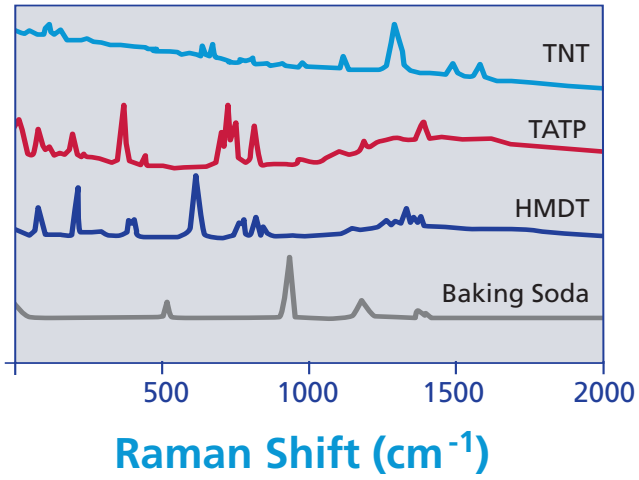

Figure 1. **The Raman spectra of TNT, TATP, HMTP, and baking soda. Each material can be uniquely indentified based on their Raman spectrum signature.**

RAMAN SPECTROSCOPY

The ***First*** **Defender**™, Ahura Corporation's handheld Raman system, makes onsite rapid explosive identification a reality. The system uses Raman spectroscopy to identify unknown liquids and solids. When a laser beam is focused on a sample, inelastic Raman scattering is produced due to the photon-molecule interaction between the material and the incident laser light. The frequencies and intensities of the Raman scattered photons relate to the conformation and electronic states of the probed molecule. Thus, the Raman spectrum of a material can be used as a unique chemical signature of the material.

The ***First*** **Defender** is the only light-weight and rugged handheld instrument for in-the-field identification of unknown solids and liquids. It sets a new standard for accuracy, applicability, durability, ruggedness, and usability over the demanding environmental requirements of the real world. The ***First*** **Defender** is capable of rapidly identifying the chemical composition of a material in less than 30 seconds.

During the operation, the Raman spectrum of the sample is collected and then matched against the stored Raman spectrum library of over one thousand chemicals. The library includes various military and industrial explosives. It also includes various chemical precursors that could be used to fabricate explosives, e.g.: hydrogen peroxide, ammonia nitrate, fuel oil, acetone, and sulfuric acid. Spectral libraries can be added in minutes by the user for additional compounds of interest. The system is also able to analyze samples though various transparent glass and plastic containers and to identify materials mixed with other contaminants.

The ***First*** **Defender** provides an alternative and complementary method against X-ray, neutron, and IMS technologies for rapid explosive detection and identification. Raman technology uses multi-dimensional molecular signatures to fingerprint the probed material, making the system much more selective than X-ray and neutron based instruments. The rapid and accurate chemical identification of suspicious materials offers homeland security and law enforcement personnel a unique tool to deter potential terrorist threats.

INNOVATIVE HAND-HELD SOLUTIONS FOR HOMELAND SECURITY AND PUBLIC SAFETY

Ahura Corporation 46 Jonspin Road > Wilmington, MA 01887 > TEL: 978.642.1132 > **www.ahuracorp.com** > **sales@ahuracorp.com**

SCAN THROUGH CONTAINERS

Figure 3 illustrates the rapid chemical identification of explosives contained in a translucent food container. The laser light passes through the polypropylene wall of the food container. The Raman light scattered by the material in the container is collected back into the instrument, where it is dispersed by the spectrometer and detected. The on-board chemometric algorithms subsequently identify the chemical composition of the material, based on matching the Raman spectra acquired with those stored in the instrument's material library. In this example, the container contains ammonium nitrate. The chemical is positively identified in less than 30 seconds, and the container never had to be opened during testing. While the spectrum and analysis results are displayed immediately, the digital data are stored for further analysis and record.

Figure 3. Ahura's ***First*** **Defender** is used to identify ammonium nitrate contained in a food container.

SUMMARY

The versatility the ***First*** **Defender** offers, with its rapid and accurate non-contact line-of-sight measurements, makes it ideal for transport terminal package screening and onsite law enforcement investigation. Results can be quickly and safely obtained within 30 seconds, with no need to expose investigators to potentially harmful materials.

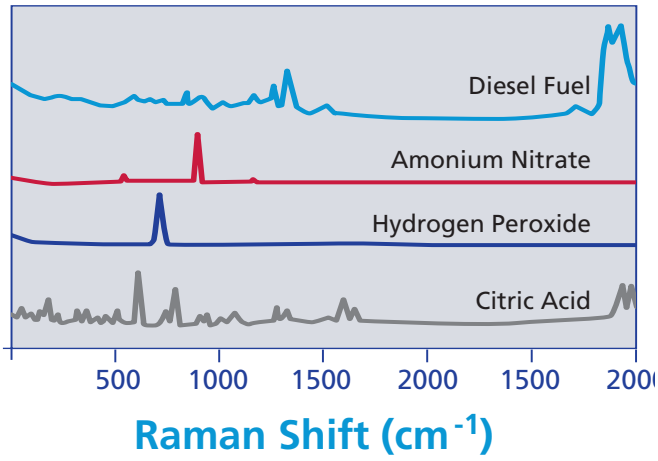

Figure 2. **The Raman spectra of diesel fuel, amonimum nitrate, hydrogen peroxide, and citric acid.**

Figure 3. **Ahura's *First* Defender is used to identify amonium nitrate contained in a food container.**

Ahura Corporation 46 Jonspin Road > Wilmington, MA 01887 > TEL: 978.642.1132 > **www.ahuracorp.com** > **sales@ahuracorp.com**