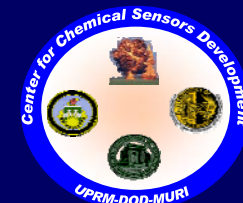




# THE CREATION OF EXPLOSIVE CONTAMINATION STANDARDS: deposition mechanisms and surface interactions studies

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## Introduction

This research focuses in studies of surface contamination properties, trace sample preparation methodologies, detection systems response and generation of explosive contamination standards for trace detection systems. Homogeneous and reproducible sample preparation is relevant for trace detection of chemical agents: warfare agents, explosives and toxic industrial chemicals. The objective is to develop technologies capable of producing explosives nanoparticles with controlled size and distribution over a surface to generate specimens that reproduce real contamination conditions.

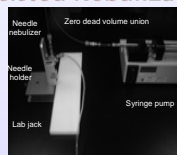
## Experimental

### Smearing



Standards were prepared using a "smearing method". Stainless Steel (SS) metal sheets (non-magnetic, type 316) with an effective area of 46.3 cm<sup>2</sup> (3.0 cm x 15.4 cm) were used. Four explosive were deposited: RDX, DNT, TNT and TATP.

### Pneumatically Assisted Nebulization



- 100 µg/mL RDX solution in methanol
- Rate of 10 µL/min
- Nebulizer pressure set at 16 psi.
- Room temperature.
- Distance of the nozzle to the substrate = 0.9 in

### Thermal Inkjet (TIJ)

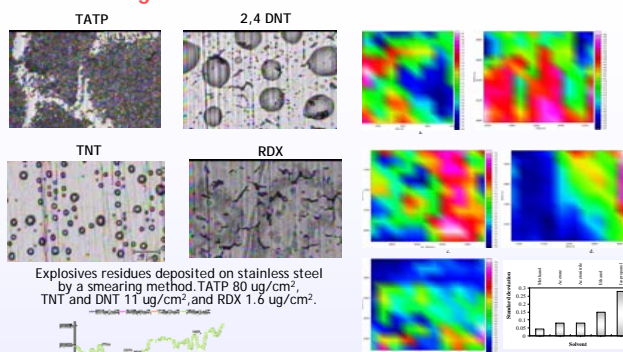


In thermal ink jet technology a thin film resistor superheats less than 0.5% of the fluid in the chamber to form a gas bubble. This bubble rapidly expands in less than ten microseconds and forces a drop to be ejected through an orifice



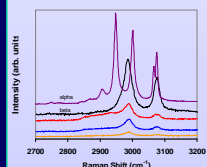
## Results

### Smearing



IR spectra of RDX on surface of SS to 107, 86.9, 7.2 and 3.6 ng/cm<sup>2</sup> and assignment of band

### Pneumatically Assisted Nebulization



Amount of RDX deposited was estimated from calibration curve obtained for Eosin Y

Exposure Time (s)	Amount of RDX deposited (ng)	Amount per Area (ng/mm <sup>2</sup> )
10	82	11
30	246	32
60	480	63

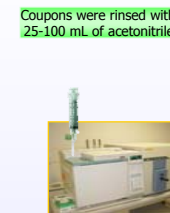
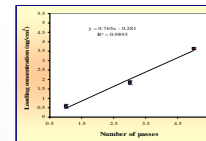
The viscosity and surface tension of the medium used for RDX solutions is similar to the medium used for the deposition of the fluorescent colorant

Control on the crystalline form being deposited of this material

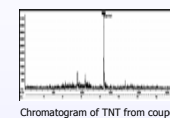
### Thermal Inkjet (TIJ)

#### Parameters

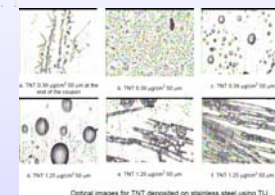
600 dpi  
0 dot spacing  
Dissolved in Acetonitrile, Methanol and 2-propanol mixture



### GC-MS determination of TNT deposited on SS by Inkjet



### Graph of loading concentration vs number of passes



## Path forward

- Trace samples with different properties can be generated with a variety of deposition mechanisms.
- Surface interaction and vehicle properties are critical for particle size, adhesion, distribution, deposition homogeneity and reproducibility.
- Surface concentration, vapor pressure have an impact on particle morphology and sample stability.

### Path forward

- o Deposition reproducibility and efficiency studies.
- o Detection reproducibility and precision will be studied for detection over different surfaces.
- o Samples stability and storage will be characterize.
- o A final publication is expected for 2009.

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