Pyrotechnic Reaction Products of a “Different Kind”

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a “Different Kind”
Disclaimer

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.
Normally GSR or Fireworks Residues come to mind when we discuss Pyrotechnic Reaction Residues and Automated SEM Particle Analysis of adhesive stub collections from hands.
We think of round particles!
Sample Sub-Stage shown with 4 stubs bearing collected residue and two stubs bearing reference standards.

Philips XL30 CP
Oxford’s ISIS EDS / WDS
Situation #1

- Subject throws M67 Hand Grenades and Thermite grenades inside tents, shoots fellow soldiers as they exit
- Subject flees the scene, apprehended in remote area
- GSR 4 stub kit - **Negative for GSR**

- Non-GSR but Ba / Cr rich particles in unclassified particles list for **GSR kit and subjects uniform**
What were those particles?

Could they be used to link the subject to the scene?
M67 Fragmentation Grenade

Anti-personnel device designed to kill, or incapacitate
Essential Components of M67 Grenade

M213 Fuze (cast Zinc)

Low Carbon Steel Grenade Body
M67 Grenade
Unique Design
Components
“Jungle” Safety Clip
Pull Ring / Safety Pin
M213 Fuze Lever
Grenade

Lever

Body

Lever

Kill radius: ~15 feet
Throw: ~120 feet

Casualty radius: ~50 feet
Fragmentation: ~750 feet
Internal Components

- "M42" Shot Gun Primer
- Spring Actuated Firing Pin
- Gas-less Delay Mixture
- Detonator (RDX base)
- Comp B (RDX/TNT) Filler
- Coined Interior Surface for Consistent Fragmentation
Typical Shrapnel

1 mm
Column of Delay Mixture

\(~ 20 \text{ mm (H)} \times \)
\(~ 5 \text{ mm (D)} \)

1.29 grams of material
Delay Mixture Type 2

- Barium Chromate (60%)
- Zirconium / Nickel Alloy (26%)
- Potassium Perchlorate (14%)

1 mm
Type II Delay Mixture

KClO$_4$
30-60 µm

Zr/Ni
15-25 µm

BaCrO$_4$
1.5 µm
Lumps 10-50 µm
1st Grenade Range Test
4 x 4 ft. box built to “Catch” Residue

- 3/4 inch plywood exterior
- ¼ inch MDF board inner face/liner
- DCU “Catch cloth” inner liner

- 4 x 4 posts along all edges/corners
- 6 inch hole in top for insertion of Grenade
1st Grenade Range Test
Delay Mixture Analysis

Philips XL30 CP
Oxford’s ISIS EDS / WDS
Uncoated
Variable Pressure
Residue Collection / Analysis

½ inch SEM

Traditional GSR Auto-Search Routine

*Element Categories Modification:*

Ba / Cr / Ni / Zr / K / Cl (Delay)

Ba / Cr / Ni / Zr  Ba / Cr  Ni / Zr

Ni  Ba (5%)
Situation #2

- Subject initiates claymore mine which kills 2 Officers in his command

- Subject throws three M67 Grenades to simulate a mortar attack as a diversionary tactic

- Subject arrested 7 days after incident
Aerial Photo Crime Scene

- Blast site
- 2 Blast sites
- Control soil
- LAKE (DRAINED)
- Claymore blast
DELAY ELEMENT classified particles found

3Suspect

Attache bag (6 particles)

Gloves (5 particles)
2nd Range Study Performed to Answer A Singular Question:

What is the Distribution Pattern for the Delay Element Residue?
Range Soil
Stake
Metal Fence
Plywood, covered with Cloth
Center ~ 4 ft from ground
Witness Plates
45 foot Radius

North

Plywood Witness Panel

M67 Grenade

Test #3
12 Witness Panels
30 Degrees Apart
Test #2
16 Witness Panels
22.5 Degrees Apart

67.5 foot Radius
North

M67 Grenade
90 foot Radius

Test #1
20 Witness Panels
18 Degrees Apart

North

M67 Grenade
Tests 1, 2 and 3
48 Witness Panels
45, 67.5 and 90 ft. radius

Prevailing Wind Direction

North
Post Detonation Collection

15 “sticks” per panel

½ inch SEM stubs

5 left / 5 center / 5 right

Range Soil
Test #3
45 foot radius

North
Test #2
67.5 foot radius

North
Test #1
90 foot radius

North
Small Rounded
Other “Indicative” Particle

Fe

Zn
Particles with Low or Absent Elements

Ni
Quartz Grains with Zinc Splattered on Surface
Questioning the Forensic Use and Utility of this Information?

June 24, 2011
Seattle Terrorism Plot Foiled as Abu Khalid Abdul-Latif & Walli Mujahidh are arrested

SEATTLE—KDVR:
Foiling a deadly terrorism plot, federal authorities Wednesday night arrested and charged two men with planning to attack a military processing office in Seattle with guns.
and grenades!!!!