URI Explosives Database

expdb.chm.uri.edu

Apps | Bookmarks | Directed Sensing | SciFinder - Sign In | ScholarOne Manuscr | Phosphorus NMR Dat | Multinuclear NMR | NMR Periodic Table | Chemistry Web Calen | DOSY Experiment | Other bookmarks

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

WELCOME

The University of Rhode Island's Explosives Database, a project funded through the auspices of the National Memorial Institute for the Prevention of Terrorism, is an interactive library of analytical data for explosive and energetic compounds. The quick links to the right will help to get you started using this sytem.

Take some time to read about the contents of the database, and when your ready, click the **Register** button to sign up for an account. Once your account has been confirmed, you can use the **Login** button to access the database.

If you have any questions or encounter any problems while using the site, please don't hesitate to **Contact Us.**

Home
Database Info
Register
Login
Contact Us

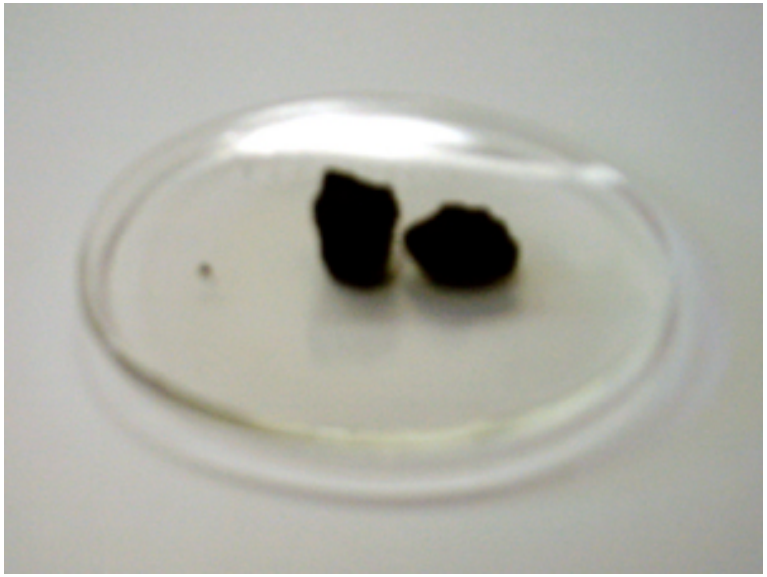
Funded By:
MIPT
National Memorial Institute for the Prevention of Terrorism
Preventing terrorism or mitigating its effects

Home | Database Info | Register | Login | Contact Us

Site last updated on May 1, 2014

http://expdb.chm.uri.edu

White Sands, NM



What is this black stuff?

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

- Potassium nitrate
- Potassium perchlorate
- Potassium Periodate
- Potassium Permanganate
- Pyrodex
- Red Dot Smokeless Powder
- Silver Nitrate
- smokeless powder generic
- Sodium benzoate
- Sodium Chlorate
- Sodium Iodate
- Sodium nitrate
- Sodium Periodate
- Sulfur
- Tetraamine-cis-bis(5-nitro-2H-tetrazolato-N2)cobalt(III) - (BNCP)
- TEX 4,10-DiNitro-2,6,8,12-TetraOxa-4,10-DiAzaiso Wurtzitane (DTIW)
- Triacetonetriperoxide (TATP)
- Triethyleneglycol dinitrate (TEGDN)
- Urea Nitrate
- Winchester smokeless powder

ABOUT THE DATABASE

This database is meant to facilitate access to analytical data, physical and experiment
mixtures. It is maintained by the University of Rhode Island Energetic Materials Rese
and James L. Smith, Ph.D.

For each analytical technique found in this collection, there is a brief overview of the
explosive identification, and the details about the methodologies employed in acquiri
clicking on the **Theory & Methodology** link on the menu bar above.

The data is organized by both chemical compound name and analytical technique. Th
access the properties of a specific compound, or obtain a list of compounds for which
item from either drop down menu to access that data. The Technical Working Group
Intact Explosives were used in the creation of this database to determine which analy
the analytical techniques found in this database may not be present on the TWGFEX
guidelines is represented herein. You can access the TWGFEX guidelines in their original form by clicking on the **TWGFEX Guidlines** link on the menu bar above.

It is recognized that this information is/may be sensitive in nature, and as such, this database system is protected by secure login with your username and password. It is importnat that you Log Out by pressing the **LOGOUT** link on the menu bar when you have finished using the system. As an authorized user of this database, you are responsible for controlling access to your username and password, as well as the use of any information obtained from this system. Please keep you username and password confidential.

Being the first of its kind, this database serves as a centralized platform upon which researchers and analysts can quickly exchange information. The quick exchnage and globalization of new discoveries, experiments and data amongst our field is a crucial aspect in ensuring our identification technologies are sound and up to date. As such, We welcome your additions/edits to the data found in this collection. If you have some analytical data you would like to add to this collection, please send the original datafile from the instrument, the instrumnet type, model number, acquisition parameters

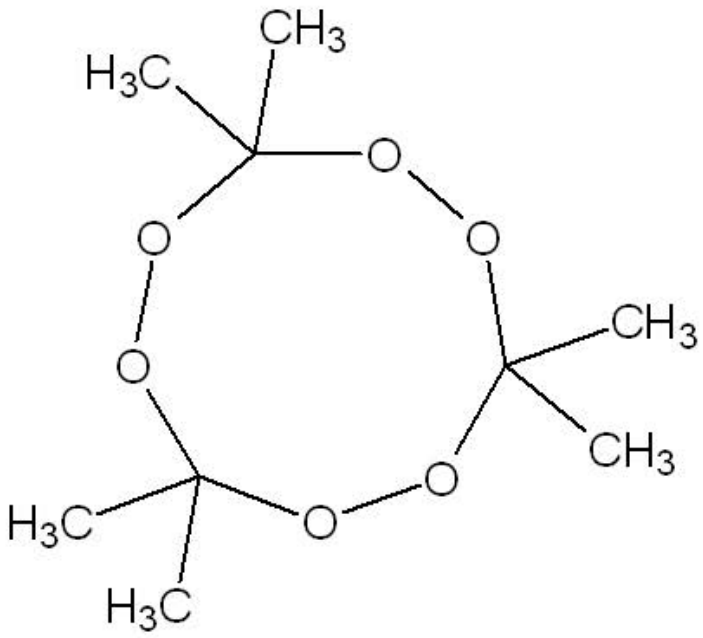
EXPLOSIVES DATABASE

Differential Scanning Calorimetry (DSC)

1,2-Dinitrobenzene
1,3,3-Trinitroazetidine (TNAZ)
1,3,5-Triamine-2,4,6-Trinitrobenzene (TATB)
1,3,5-triazine-2,4,6-triol (Cyanuric acid)
1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
1,4-dinitraio-2,3-dinitro-2,3 bis(nitraiomethylene)butane (DNTN/SMX)
1,4-Dinitrobenzene
2,3-Dimethyl-2,3-dinitrobutane (DMNB)
2,3-Dinitrotoluene
2,4 dinitroaniline
2,4,6-trinitrophenol (Picric Acid)
2,4,6-Trinitrotoluene (TNT)
2,4-Dinitrotoluene
2,6-bis(picrylamino)]-3,5 dinitropyridine (PYX)
2,6-Dinitrotoluene
3,4-Dinitrotoluene
3-Nitro-1,2,4-triazol-5-one (NTO)
4-Nitrotoluene
Ammonium nitrate
Ammonium perchlorate
Ascorbic acid
Barium Nitrate
Biuret Powder
Black Powder
bullseye
Calcium Hypochlorite
Dextrinated lead azide
Diazodinitrophenol (DDNP)
Dicyanodiamide
Double Base
Erythritol
Erythritol tetranitrate (ETN)
Ethylene diamine dinitrate (EDDN)
Ethylene Glycol Dinitrate (EGDN)
Ethylenedintramine (EDNA)
Guanidine Nitrate (QN)
Hexamethylenetriperoxidediamine (HMTD)
Hexanitrohexaazaisowurtzitane (CL-20)
Hexhydro-1,3,5-trinitro-1,3,5-triazine (RDX)
IMR Smokeless Powder
Lead azide
Mercury 5-Nitrotetrazole (DXN-1)
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)
Nitrocellulose
Nitroglycerin
NitroGuanidine (NQ)
Nitrourea
Octahydro-1,3,5,7-tetranitro-1,3,5-tetrazocine (HMX)
Pentaerythritol tetranitrate (PETN)
Potassium Chlorate
Potassium Dichromate
Potassium Dinitrobenzofuroxan (KDNBF)
Potassium nitrate
Potassium perchlorate
Pyrodex
Red Dot Smokeless Powder
Silver Nitrate
Sodium benzoate
Sodium Chlorate
Sodium nitrate
Sulfur
Tetraamine-cis-bis(5-nitro-2H-tetrazolato-N2)cobalt(III) - (BNCP)
TEX 4,10-DiNitro-2,6,8,12-TetraOxa-4,10-DiAzaiso Wurtzitane (DTIW)
Triacetonetriperoxide (TATP)
Urea Nitrate
Winchester smokeless powder

Triacetonetriperoxide (TATP)

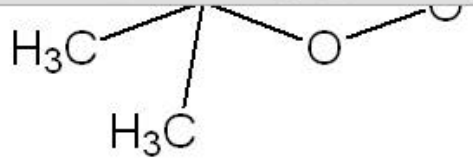
CHEMICAL STRUCTURE



PHYSICAL PROPERTIES

Classification:	high explosive
Physical Description:	white crystalline solid
Formula:	$C_9H_{18}O_6$
Molecular Weight:	222.24
CAS Number:	17088-37-8
Oxygen Balance:	-151.2 %
Nitrogen Percentage:	
Density:	1.18 g/cm^3 1.20 g/cm^3
Energy of Formation:	
Enthalpy of Formation:	
Melting Point:	91 - 98°C
Melting Enthalpy:	
Specific Energy:	
Specific Heat @ 20°C:	
Heat of Explosion:	
Vapor Pressure:	0.05 Torr at 25°C
Deflagration:	
Solubility:	It is barely soluble in methanol, glycerin and isoamylalcohol. It is soluble in some organic solvents at 17°C as follows: absol alc 0.15%, ether 5.5%, acetone 9.15%, trichloroethylene 22.7%, benzene 18.0%, pyridine 15.4%, chloroform 42.5% and pet ether 7.35%.

SAFETY & SENSITIVITY



Specific Energy:
Specific Heat @ 20°C:
Heat of Explosion:
Vapor Pressure: 0.05 Torr at 25°C
Deflagration:
Solubility: It is barely soluble in methanol, glycerin and isoamylalcohol. It is soluble in some organic solvents at 17°C as follows: absol alc 0.15%, ether 5.5%, acetone 9.15%, trichloroethylene 22.7%, benzene 18.0%, pyridine 15.4%, chloroform 42.5% and pet ether 7.35%.

SAFETY & SENSITIVITY

Small Scale Gap Test	Large Scal Gap Test	Lead Block Test	Volume of Detonation Gases	Detonation Velocity, Confined
		260 cm^3		5300 m/s

Impact Sensitivity	Friction Sensitivity	Pistil Load	Critical Diameter Steel Sleeve
0.03 kg m	0.01 kg f		

OTHER NAMES
TATP

SYNTHESIS
TATP can be synthesised from acetone, hydrogen peroxide and an acid catalyst at low temperature.

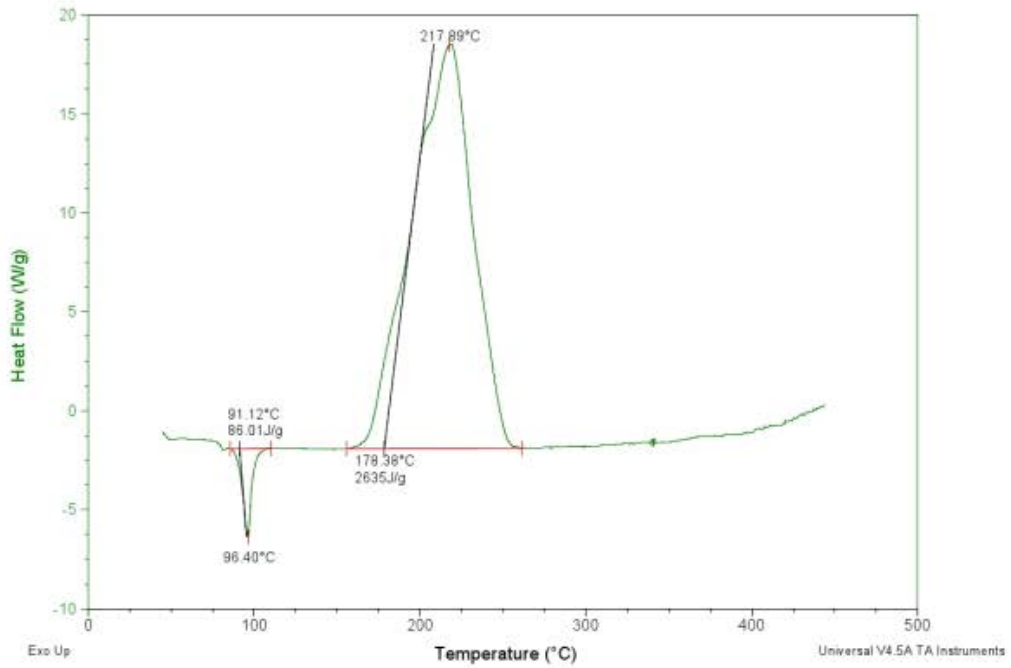
AVAILABLE DATA:
DSC | ATR-IR | Raman | EIMS | PCIMS | NCIMS | ^{1}H NMR | ^{13}C NMR |

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Differential Scanning Calorimetry Thermograph



DESCRIPTION

Capillary DSC
Sample: TATP
Size: 0.4160 mg
Method: Ramp 20° C per minute
Run Date: 28-Sep-06
Instrument: DSC Q100 V9.8 Build 296
Source: URI

DOWNLOADABLE FORMATS

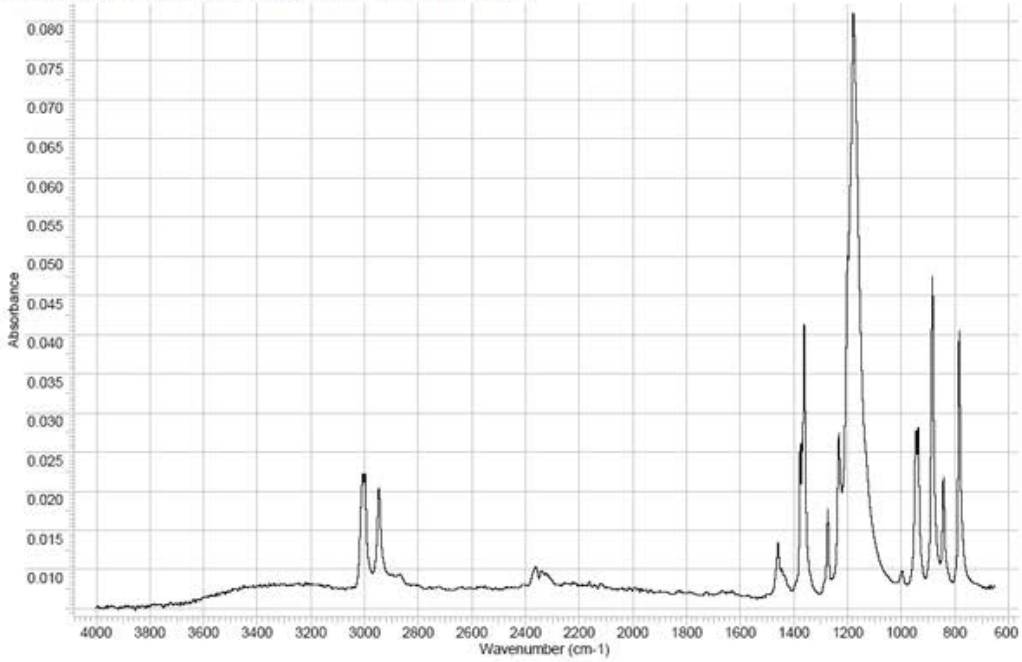
TATP.doc
TATP.txt

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Attenuated Total Reflectance Infrared Spectrum



DESCRIPTION

Scans = 64

Resolution = 4 cm^{-1}

Background Scans = 64

Absorbance Spectrum

Source = URI

DOWNLOADABLE FORMATS

Triacetonetriperoxide_absorbance.txt
Triacetonetriperoxide_absorbance.jdx
Triacetonetriperoxide_absorbance.PDF
Triacetonetriperoxide_absorbance.spc

DESCRIPTION

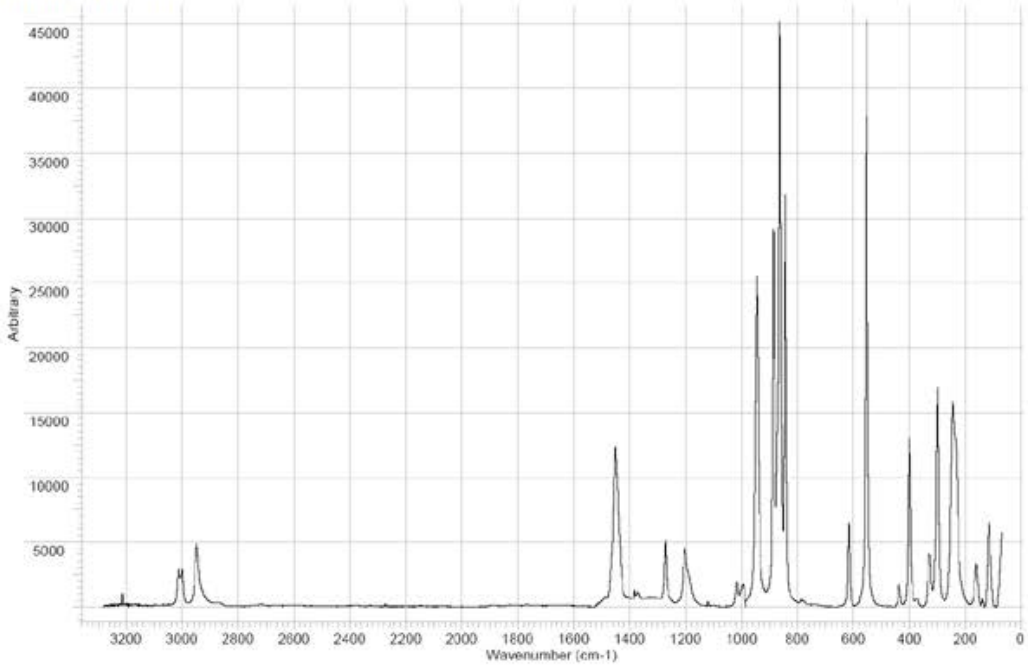
Scans = 64

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Raman Spectrum



DESCRIPTION

Laser Excitation Wavelength = 785 nm
Slit Dimensions = 50 x 1000 um
Scans = 1
Background Scans (Dark Spectrum) = 1
Accumulation Time = 100 s
Resolution = 3 - 5 cm^{-1}
Media = SpectRIM Slides (Tienta Science)

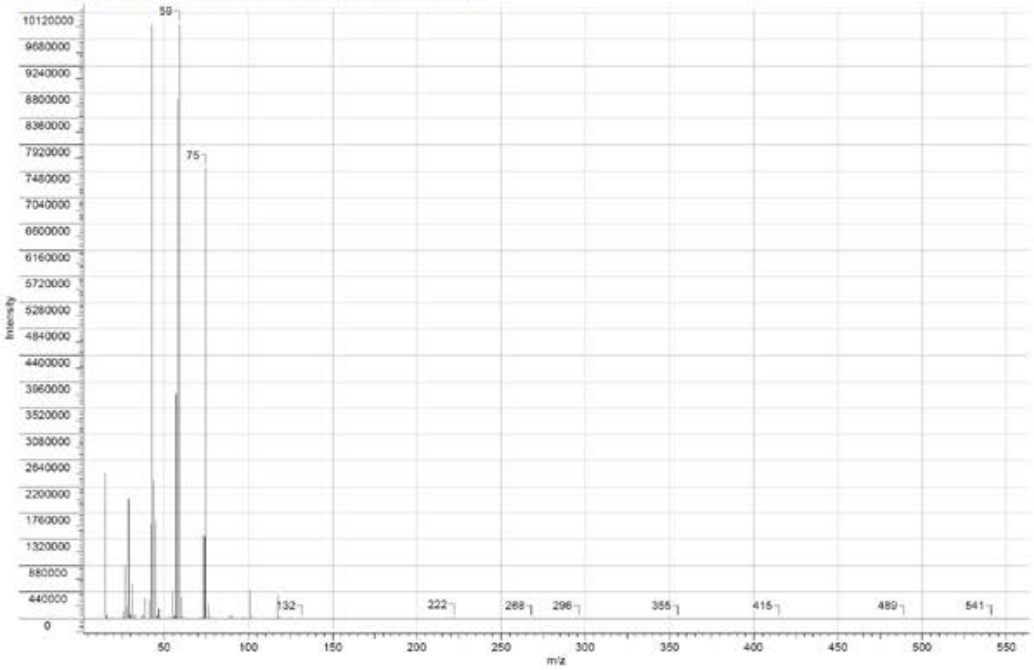
DOWNLOADABLE FORMATS

Triacetonetriperoxide (TATP)_2_raman.txt
TRIACETONETRIPEROXIDE (TATP)_2_RAMAN.esp
Triacetonetriperoxide (TATP)_2_raman.PDF
Triacetonetriperoxide (TATP)_2_raman.spc

EXPLOSIVES DATABASE

Triacetonetriperoxide (TATP)

Electron Impact Ionization Mass Spectrum



DESCRIPTION

Instrument: Agilent 6890 Network GC / Agilent 5973 inert MSD
Column: J & W Scientific DB-5MS (30m x 0.25mm x 0.25um)
Column mode: constant flow
Initial flow: 0.8 mL/min
Oven temperature program: 50°C - 200°C by 10°C/min
Inlet mode: Pulsed Splitless
Initial temp: 150°C
Pressure: 5.29 psi
Pulse pressure: 18.5 psi
Pulse time: 1.50 min
Carrier gas type: Helium
Solvent delay: 4.00 min
Acquisition mode: Scan
Low mass: 15.0
High mass: 550.0
Threshold: 0
MS quad temperature: 150°C
MS source temperature: 230°C
Source: URI

DOWNLOADABLE FORMATS

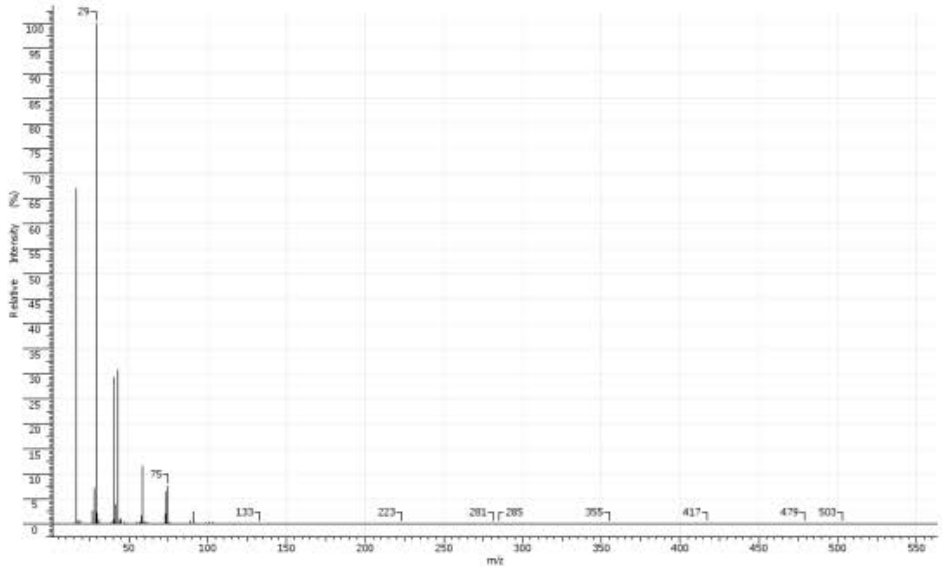
EI-triacetone-triperoxide-(TATP).txt

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Positive Chemical Ionization Mass Spectrum



DESCRIPTION

Sample: Triacetonetriperoxide
Instrument: Agilent 6890 Network GC / 5973 Inert MSD
Specifications: Reported in acqmeth.txt link
Source: URI

DOWNLOADABLE FORMATS

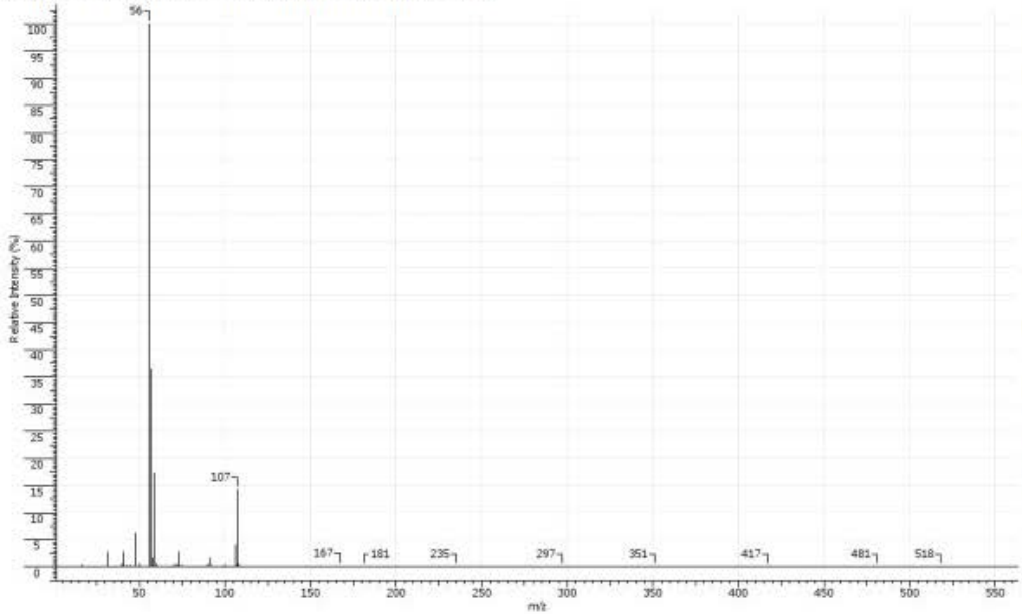
acqmeth.txt
PCITATP_ei.jdx
PCITATP_ei.PDF
PCITATP_ei.txt

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Negative Chemical Ionization Mass Spectrum



DESCRIPTION

Instrument: Agilent 6890 Network GC / Agilent 5973 inert MSD Column: J & W Scientific DB-5MS (30m x 0.25mm x 0.25um) Column mode: constant flow Initial flow: 0.8 mL/min Oven temperature program: 50°C - 200°C by 10°C/min Inlet mode: Pulsed Splitless Initial temp: 150°C Pressure: 5.29 psi Pulse pressure: 18.5 psi Pulse time: 1.50 min Carrier gas type: Helium Solvent delay: 4.00 min Acquisition mode: Scan Low mass: 15.0 High mass: 550.0 Threshold: 0 MS quad temperature: 150°C MS source temperature: 150°C Source: URI

DOWNLOADABLE FORMATS

Triacetonetriperoxide_ncims_nci.jdx
Triacetonetriperoxide_ncims_nci.PDF
Triacetonetriperoxide_ncims_nci.txt

URI Explosives Database

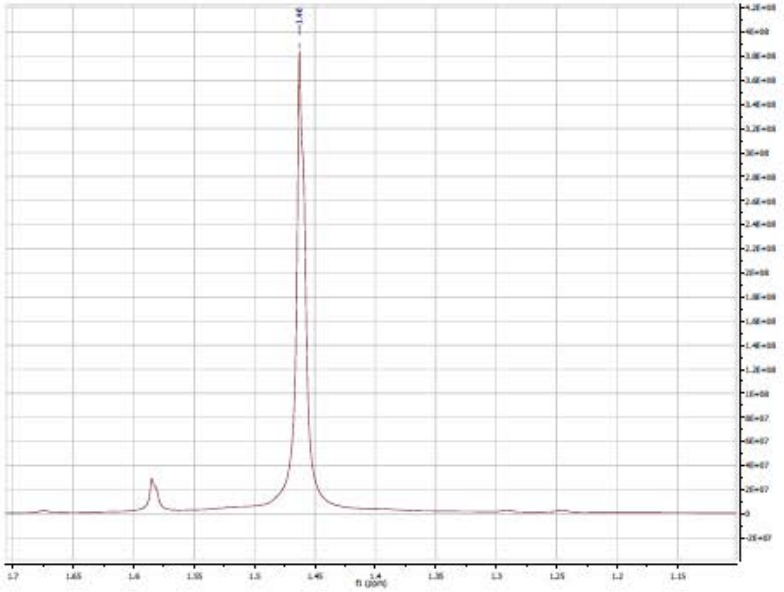
expdb.chm.uri.edu/getdata.php?id=846

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Proton Nuclear Magnetic Resonance Spectrum



DESCRIPTION

TATP

DOWNLOADABLE FORMATS

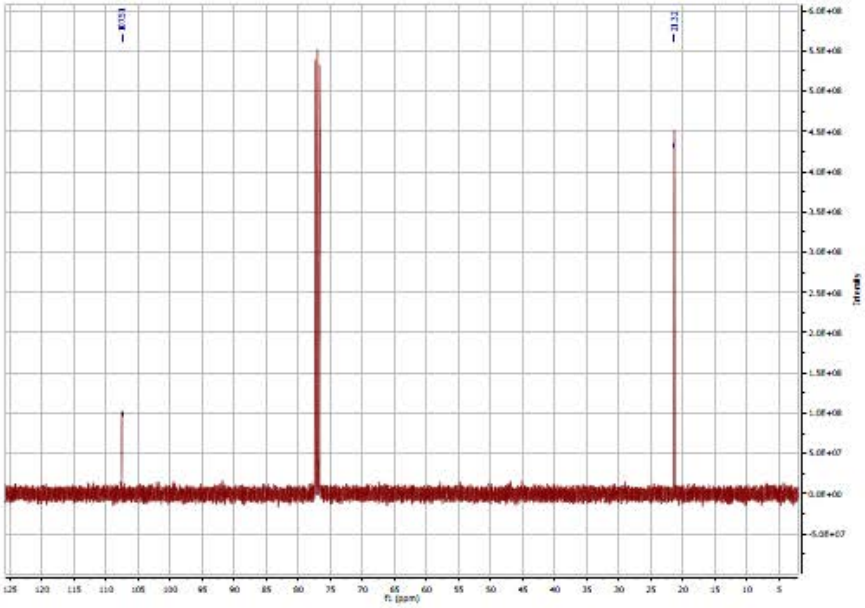
TATP 1H.pdf

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

Triacetonetriperoxide (TATP)

Carbon-13 Nuclear Magnetic Resonance Spectrum

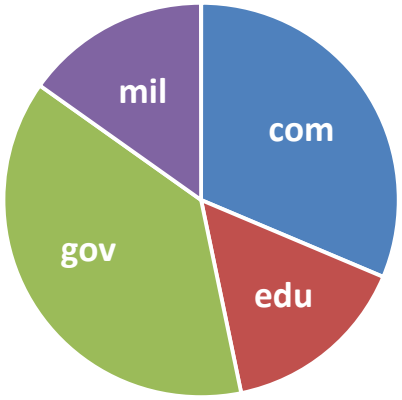


DESCRIPTION

DOWNLOADABLE FORMATS

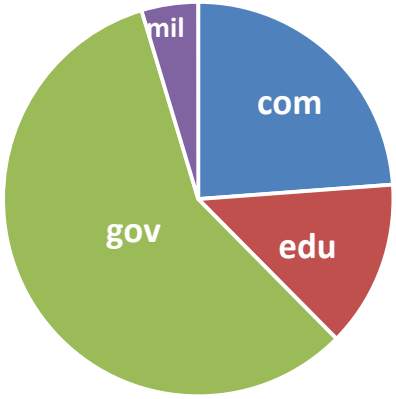
TATP C13.pdf

Explosive Database



U.S.

U.S.		Foreign
357	gov	148
294	com	61
144	edu	35
142	mil	12



International

USA	681	Netherlands	7	Bahrain	2	Sweden	2	Kazakhstan	1
UK	61	Portugal	6	Brazil	2	Taiwan	2	Kuwait	1
Canada	27	Italy	5	Bulgaria	2	Turkey	2	Malaysia	1
France	17	Singapore	5	China	2	UAE	2	Mali	1
India	16	Germany	4	Costa Rica	2	Armenia	1	Northern Ireland	1
Australia	13	Czech Republic	3	Indonesia	2	Denmark	1	Pakistan	1
Israel	12	Mexico	3	Ireland	2	Finland	1	Saudi Arabia	1
Belgium	8	Norway	3	Qatar	2	Greece	1	Sri Lanka	1
Columbia	8	South Africa	3	Romania	2	Iran	1	Ukraine	1
Spain	8	Switzerland	3	Russia	2	Japan	1	Uruguay	1

2007-2015:
937 Registrations
(246 international
from 49 countries)

Since 2016
+41 US
+29 international

expdb.chm.uri.edu

Issues

Tedious

Consistency

Updating

Search & Match

Future Work

Explosive Literature

Toxicity

Commercialization

Bio Rad

Fiveash

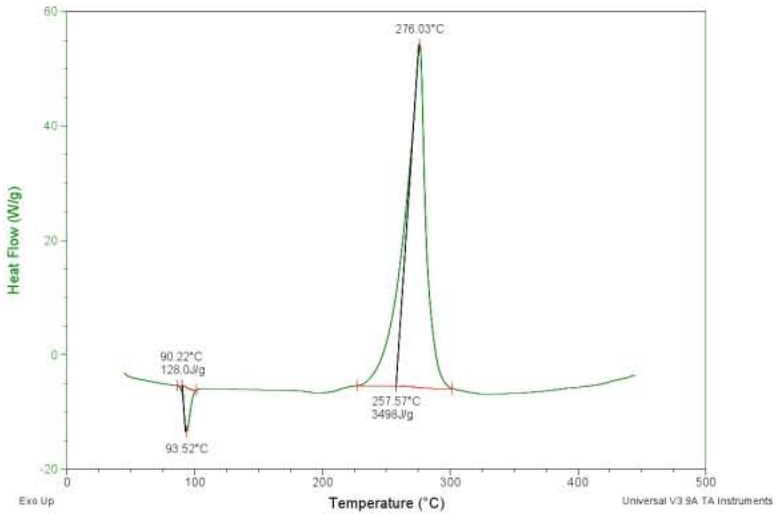

ENDLESS
POSSIBILITIES
GIFT OF THE CLASS
OF 1958

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

1,3,3-Trinitroazetidine (TNAZ)

Differential Scanning Calorimetry Thermograph



DESCRIPTION
Capillary DSC
Sample: 1,3,3-Trinitroazetidine_1
Size: 0.2340 mg
Method: Ramp 20° C per minute
Temp Range: 50 - 450° C
Run Date: 10-Aug-05
Instrument: DSC Q100 V9.8 Build 261
Source: URI

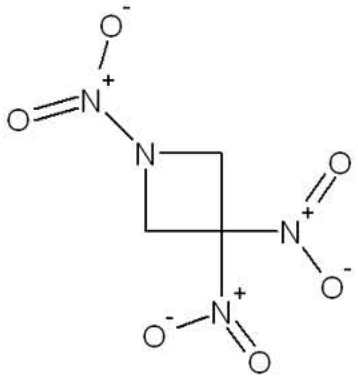
DOWNLOADABLE FORMATS
TNAZ_1.doc
TNAZ _1.txt

DESCRIPTION
Capillary DSC
Sample: 1,3,3-Trinitroazetidine_2
Size: 0.2290 mg
Method: Ramp 20° C per minute

EXPLOSIVES DATABASE

1,3,3-Trinitroazetidine (TNAZ)

CHEMICAL STRUCTURE



PHYSICAL PROPERTIES

Classification:	
Physical Description:	
Formula:	$C_3H_4N_4O_6$
Molecular Weight:	
CAS Number:	97645-24-4
Oxygen Balance:	-16.7 %
Nitrogen Percentage:	
Density:	1.84 g/cm^3
Energy of Formation:	
Enthalpy of Formation:	
Melting Point:	101°C
Melting Enthalpy:	
Specific Energy:	
Specific Heat @ 20°C:	
Heat of Explosion:	
Vapor Pressure:	
Deflagration:	>240°C
Solubility:	

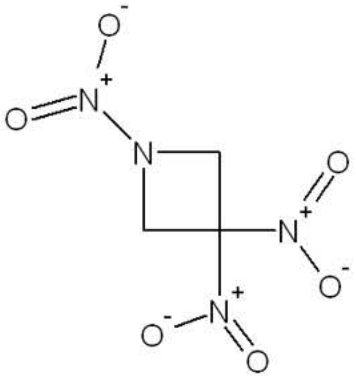
SAFETY & SENSITIVITY

Small Scale Gap Test	Large Scal Gap Test	Lead Block Test	Volume of Detonation Gases	Detonation Velocity, Confined

Impact Sensitivity	Friction Sensitivity	Pistil Load	Critical Diameter Steel Sleeve

1,3,3-Trinitroazetidine (TNAZ)

CHEMICAL STRUCTURE



PHYSICAL PROPERTIES

Classification:	
Physical Description:	
Formula:	$C_3H_4N_4O_6$
Molecular Weight:	
CAS Number:	97645-24-4
Oxygen Balance:	-16.7 %
Nitrogen Percentage:	
Density:	1.84 g/cm^3
Energy of Formation:	
Enthalpy of Formation:	
Melting Point:	101°C
Melting Enthalpy:	
Specific Energy:	
Specific Heat @ 20°C:	
Heat of Explosion:	
Vapor Pressure:	
Deflagration:	>240°C
Solubility:	

SAFETY & SENSITIVITY

Small Scale Gap Test	Large Scal Gap Test	Lead Block Test	Volume of Detonation Gases	Detonation Velocity, Confined

Impact Sensitivity	Friction Sensitivity	Pistil Load	Critical Diameter Steel Sleeve

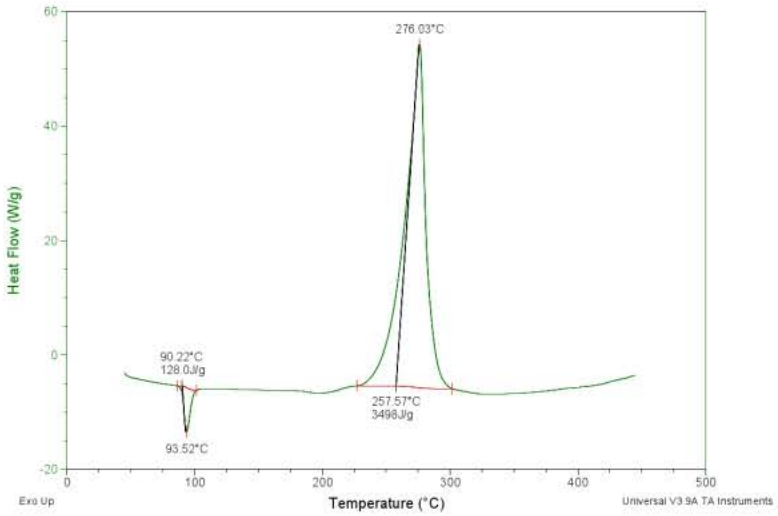
OTHER NAMES
TNAZ

SYNTHESIS

AVAILABLE DATA:
DSC | ATR-IR | Raman | EIMS | PCIMS |

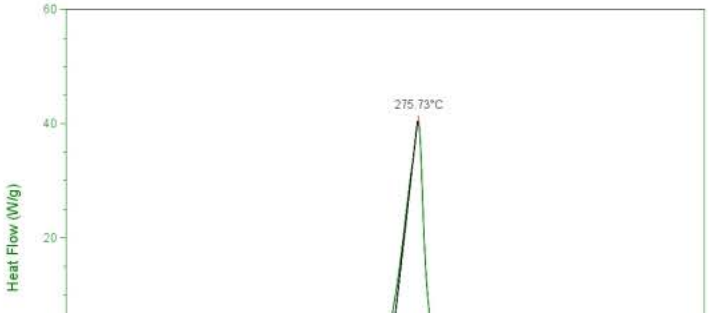
1,3,3-Trinitroazetidine (TNAZ)

Differential Scanning Calorimetry Thermograph



DESCRIPTION
Capillary DSC
Sample: 1,3,3-Trinitroazetidine_1
Size: 0.2340 mg
Method: Ramp 20° C per minute
Temp Range: 50 - 450° C
Run Date: 10-Aug-05
Instrument: DSC Q100 V9.8 Build 261
Source: URI

DOWNLOADABLE FORMATS
TNAZ_1.doc
TNAZ _1.txt



DESCRIPTION
Capillary DSC
Sample: 1,3,3-Trinitroazetidine_2
Size: 0.2290 mg
Method: Ramp 20° C per minute
Temp Range: 50 - 450° C
Run Date: 10-Aug-05
Instrument: DSC Q100 V9.8 Build 261
Source: URI

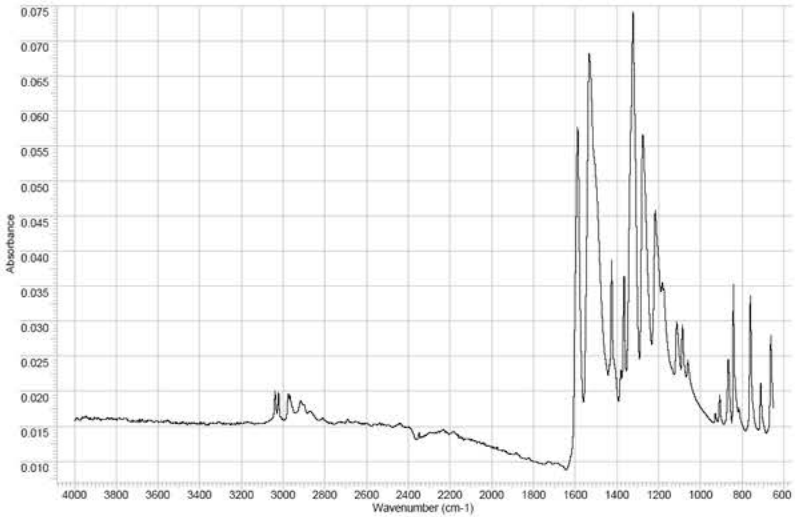
DOWNLOADABLE FORMATS
TNAZ_2.doc
TNAZ_2.txt

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

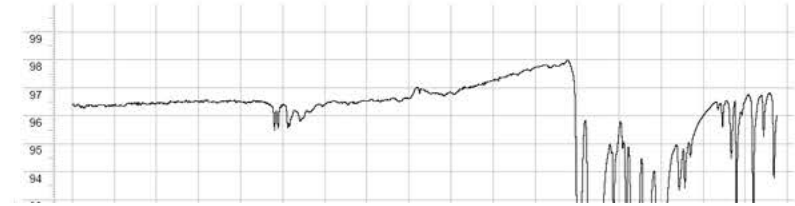
1,3,3-Trinitroazetidine (TNAZ)

Attenuated Total Reflectance Infrared Spectrum



DESCRIPTION
Scans = 64
Resolution = 4 cm^{-1}
Background Scans = 64
Absorbance Spectrum

DOWNLOADABLE FORMATS
1,3,3-Trinitroazetidine_2_absorbance.txt
1,3,3-Trinitroazetidine_2_absorbance.jdx
1,3,3-Trinitroazetidine_2_absorbance.PDF
1,3,3-Trinitroazetidine_2_absorbance.spc



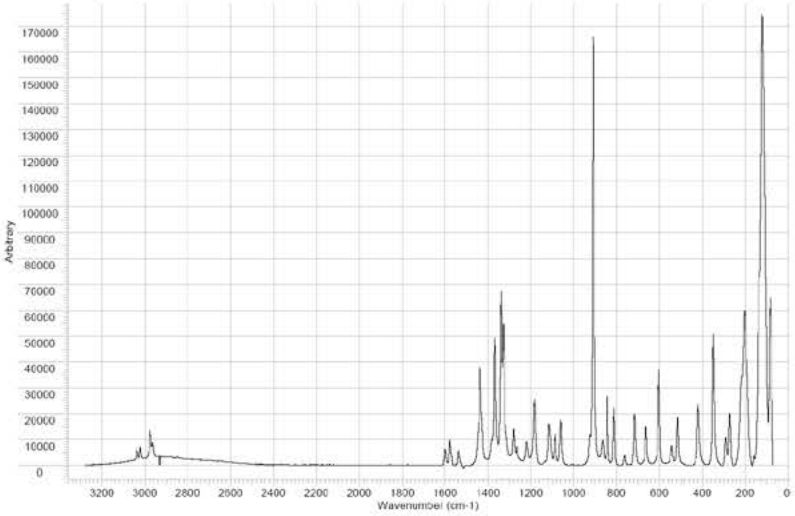
DESCRIPTION
Scans = 64
Resolution = 4 cm^{-1}
Background Scans = 64
Transmittance Spectrum

DOWNLOADABLE FORMATS
1,3,3-Trinitroazetidine_2_transmittance.txt

EXPLOSIVES DATABASE

1,3,3-Trinitroazetidine (TNAZ)

Raman Spectrum



DESCRIPTION
Laser Excitation Wavelength = 785 nm
Slit Dimensions = 50 x 1000 um
Scans = 1
Background Scans (Dark Spectrum) = 1
Accumulation Time = 100 s
Resolution = 3 - 5 cm^{-1}
Media = SpectRIM Slides (Tienta Science)

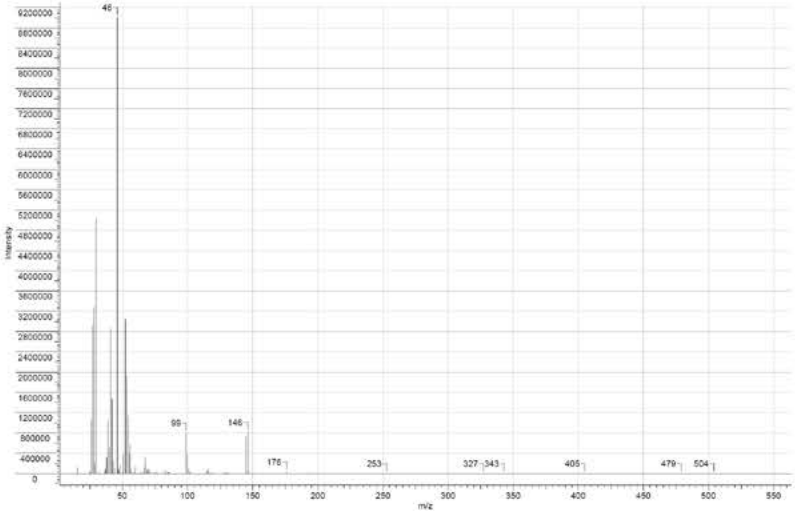
DOWNLOADABLE FORMATS
1,3,3-Trinitroazetidine (TNAZ)_raman.txt
1,3,3-Trinitroazetidine (TNAZ)_raman.jdx
1,3,3-Trinitroazetidine (TNAZ)_raman.PDF
1,3,3-TRINITROAZETIDINE (TNAZ)_RAMAN.esp

EXPLOSIVES DATABASE

UNIVERSITY OF Rhode Island

1,3,3-Trinitroazetidine (TNAZ)

Electron Impact Ionization Mass Spectrum



DESCRIPTION

Instrument: Agilent 6890 Network GC / Agilent 5973 inert MSD
Column: J & W Scientific DB-5MS (30m x 0.25mm x 0.25um)
Column mode: constant flow
Initial flow: 0.8 mL/min
Oven temperature program: 50°C - 200°C by 40°C/min - 300°C by 10°C/min
Inlet mode: Pulsed Splitless
Initial temp: 195°C
Pressure: 5.27 psi
Pulse pressure: 18.5 psi
Pulse time: 1.50 min
Carrier gas type: Helium
Solvent delay: 4.00 min
Acquisition mode: Scan
Low mass: 15.0
High mass: 550.0
Threshold: 0
MS quad temperature: 150°C
MS source temperature: 230°C
Source: URI

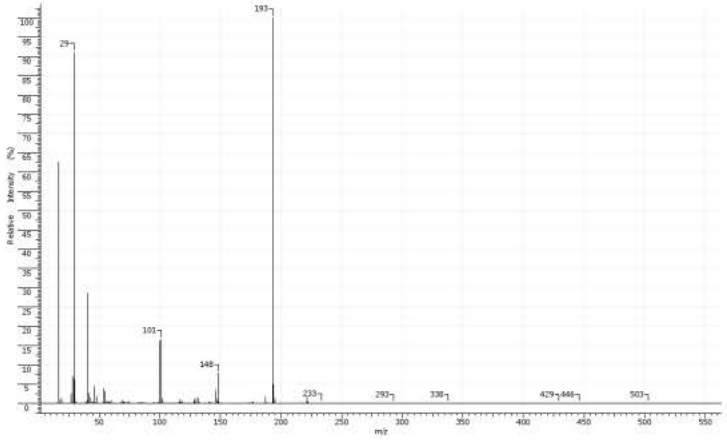
DOWNLOADABLE FORMATS

133Trinitroazetidine(TNAZ)_eims.txt
133Trinitroazetidine(TNAZ)_eims.jdx
133Trinitroazetidine(TNAZ)_eims_eims.PDF
133Trinitroazetidine(TNAZ)_eims.cdf

EXPLOSIVES DATABASE

1,3,3-Trinitroazetidine (TNAZ)

Positive Chemical Ionization Mass Spectrum



DESCRIPTION

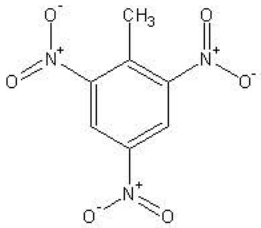
Sample: 1,3,3-Trinitroazetidine
Instrument: Agilent 6890 Network GC / 5973 Inert MSD
Specifications: Reported in acqmeth.txt link
Source: URI

DOWNLOADABLE FORMATS

acqmeth.txt
PCITNAZ_ei.jdx
PCITNAZ_ei.PDF
PCITNAZ_ei.txt

2,4,6-Trinitrotoluene (TNT)

CHEMICAL STRUCTURE



PHYSICAL PROPERTIES

Classification:	High explosive
Physical Description:	Pale yellow Crystals; if granulated, flakes[1]
Formula:	$C_7H_5N_3O_6$
Molecular Weight:	227.13
CAS Number:	118-96-7
Oxygen Balance:	-73.9%[1]
Nitrogen Percentage:	18.5%[1]
Density:	crystal:1.654 g/cm^3 molten:1.47 g/cm^3 [1]
Energy of Formation:	-44.2 kcal/kg[1]
Enthalpy of Formation:	-62.5 kcal/kg[1]
Melting Point:	80.65°C[1]
Melting Enthalpy:	23.1 kcal/kg[1]
Specific Energy:	870 kJ/kg[1]
Specific Heat @ 20°C:	0.331 kcal/kg[1]
Heat of Explosion:	**Calculated** H2O (gas); 1050 kcal/kg H2O (Liq.); 1080 kcal/kg **Experimental** H2O(Liq.); 1090 kcal/kg[1]
Vapor Pressure:	

Temperature (°C)	Vapor Pressure (Torr)
25	5.8x10^{-6}
81	0.043
100	0.105
150	3.0
200	10.5
250	64.9

Deflagration:	300°C
Solubility:	almost insoluble in water, sparingly soluble in alcohol and soluble in benzene, toluene and acetone[1]

SAFETY & SENSITIVITY

Small Scale Gap Test			Large Scal Gap Test			Lead Block Test	Volume of Detonation Gases	Detonation Velocity, Confined	
density		Log	density	G$_{50}$	Log	300[1]	730L/kg [1]	Density (g/cm^3)	Velocity (m/s)

Deflagration:	300°C
Solubility:	almost insoluble in water, sparingly soluble in alcohol and soluble in benzene, toluene and acetone[1]

SAFETY & SENSITIVITY

Small Scale Gap Test

density (g/cm^3)	G_{50} (mm)	L_{95} (mm)
0.77	4.11	0.08
1.628	0.33	0.05
0.84	no go at zero gap	

Large Scal Gap Test

density (g/cm^3)	G_{50} (mm)	L_{95} (mm)
0.800	61.49	0.38
1.024	61.54	0.20
1.222	56.26	0.08
1.356	55.02	0.25
1.505	54.92	0.30
1.551	54.46	0.28
1.595	52.53	0.18
1.631	46.43	0.30
1.615	28.30	0.64

Lead Block Test

300[1]

Volume of Detonation Gases

730L/kg [1]

Detonation Velocity, Confined

Density (g/cm^3)	Velocity (m/s)
1.60	6900

Impact Sensitivity	Friction Sensitivity	Pistil Load	Critical Diameter Steel Sleeve
15[1] Test in PicArsn app, 2-kg wt 40°C; 17 inches room; 14 inches 80°C; 7 inches 90°C; 3 inches[2]	up to 353 N[1] Pendulum Friction test is 0; Rifle Bullet test is 1 (low order) at 475°C[2]	no reaction[1]	

OTHER NAMES

Tolite in France, Tutol, Trinol in German; Benzene, 2-methyl-1,3,5-trinitro-; Toluene, 2,4,6-trinitro-; α-TNT; s-Trinitrotoluene; s-Trinitrotoluol; Tolite; Tritol; Trotyl; TNT; 2-Methyl-1,3,5-Trinitrobenzene; 2,4,6-Trinitrotoluene; syn-Trinitrotoluene; sym-Trinitrotoluol; NCI-C56155; Entsufon; Tnt-tolite; Triton; Trojnitrotoluen; 2,4,6-Trinitrotolueen; 2,4,6-Trinitrotoluol; Tolit; sym-Trinitrotoluene; Trotyl oil; UN 0209; UN 1356; 1-Methyl-2,4,6-trinitrobenzene; 2,4,6-TNT

SYNTHESIS

Toluene is nitrated in a three stage process by using increasing temperatures and mixed nitric and sulfuric acids to introduce intro groups successing to form 2 and 4-monitrotoluene(MNT), 2,4-and 2,6-dinitrotoluene(DNT) and 2,4,6-trinitrotoluene. Numerous other compounds are also formed. These undesireed compounds are removed from the mixture by treatment with aqueous sodium sulfite solution (sellite), which reacts woth most compounds, except the desireed 2,4,6-isomer to form water soluble sufonate derivatives[1].

AVAILABLE DATA:

DSC | ATR-IR | Raman | EIMS | PCIMS | ^{1}H NMR | ^{13}C NMR |

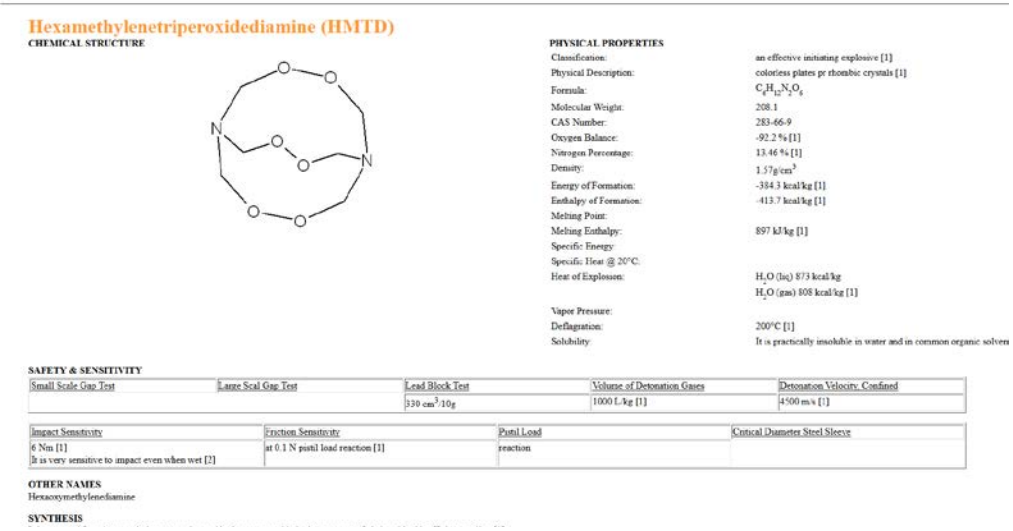
Transition Database of Physical Properties

R1-A.1

Characterization data goes in the database.

What's in the database? Physical properties:

IR, Raman, EI & CI Mass spectra, ^{1}H & ^{13}C NMR



Hexamethylenetriperoxidediamine (HMTD)

CHEMICAL STRUCTURE

PHYSICAL PROPERTIES

Classification:	an effective initiating explosive [1]
Physical Description:	colorless plates pr rhombic crystals [1]
Formula:	$C_6H_{12}N_2O_6$
Molecular Weight:	208.1
CAS Number:	283-66-9
Oxygen Balance:	-92.2 % [1]
Nitrogen Percentage:	13.46 % [1]
Density:	1.57g/cm^3
Energy of Formation:	-384.3 kcal/kg [1]
Enthalpy of Formation:	-413.7 kcal/kg [1]
Melting Point:	
Melting Enthalpy:	897 kJ/kg [1]
Specific Energy:	
Specific Heat @ 20°C:	
Heat of Explosion:	H_2O (liq) 873 kcal/kg H_2O (gas) 808 kcal/kg [1]
Vapor Pressure:	
Deflagration:	200°C [1]
Solubility:	It is practically insoluble in water and in common organic solven

SAFETY & SENSITIVITY

Small Scale Gap Test	Large Scal Gap Test	Lead Block Test	Volume of Detonation Gases	Detonation Velocity, Confined
		330 cm^3/10g	1000 L/kg [1]	4500 m/s [1]

Impact Sensitivity	Friction Sensitivity	Pistil Load	Critical Diameter Steel Sleeve
6 Nm [1] It is very sensitive to impact even when wet [2]	at 0.1 N pistil load reaction [1]	reaction	

OTHER NAMES

Hexaoxymethylenediamine

SYNTHESIS

2007-2015 937 registrations (2-26) +40 domestic

(246 international from 49 countries) +28 international

New idea is to add a compendium of useful papers

Two potential licensees—
FDM & BioRad