

# Index

Note: Page numbers followed by “f” and “t” indicate figures and tables respectively

## A

Activation energy, 8, 20–21, 72–74, 73f  
ADN. *See* Ammonium dinitramide  
Airbag, 214–216  
Airblast overpressure, 167, 167t  
Ammonium dinitramide (ADN), 153–154, 187–188, 189f, 203–204  
Ammonium nitrate, 94–95  
Ammonium perchlorate, 9–10, 154, 169, 187, 188f  
Angina and NG, 218  
Antacids, 128  
Arrhenius equation, 73  
Auxoploses, 74–75  
Avalanche control, 99–100, 217–218

## B

Ball powder, 10, 115, 121  
Ballistics, 37, 116, 142–145  
Ballistite, 4–5, 15t  
Becker-Kistiakowsky-Wilson method (BKW method), 64–65  
Bipropellant, 136, 137f  
Bis-(5-nitro-2H-tetrazolato-N<sup>2</sup>) tetramine cobalt(III) perchlorate (BNCP), 195, 196f  
BKW method. *See* Becker-Kistiakowsky-Wilson method

Blast wave, 91–94  
Blasting agents, 97–100  
Blasting gelatin, 4–5, 125  
BNCP. *See* Bis-(5-nitro-2H-tetrazolato-N<sup>2</sup>) tetramine cobalt(III) perchlorate  
Bomb calorimeter, 28–29  
Brisance, 37, 45, 87–88  
Burn rate catalysts, 12t, 143–144, 149, 153  
Burning rate coefficient, 116, 142

## C

C-J pressure, 58f  
Calorimetric value, 28, 143, 147–148, 148t, 181  
Canopy severance, 218  
Cartridge case, 10, 45–46, 105–106, 108–110, 112–113, 117, 130  
CD nozzle. *See* Convergent-Divergent Nozzle  
Chamber Pressure, 134, 141–143  
Characteristic velocity, 144–145  
Charge diameter, 78, 90–91  
China Lake-20 (CL-20), 59t, 184, 184t, 186f, 188, 197  
Chromatography, 181–183  
CL-20. *See* China Lake-20  
Closed vessel test, 118  
CMDB propellant. *See* Composite modified double-base propellant  
Compatibility assessment, 189

Composite modified double-base propellant (CMDB propellant), 148  
Composite propellants, 9–10, 12t, 142–143  
Compression wave, 77, 89, 89f  
Conjugated double bonds, 184  
Controlled demolition, 212–214  
Convergent-Divergent Nozzle (CD nozzle), 133–134  
Coronary heart disease and NG, 218

## D

DDT. *See* Deflagration-to-Detonation Transition  
Decoppering agents, 130  
Decoy flares, 158  
Deflagration, 52–56, 55t  
Deflagration-to-Detonation Transition (DDT), 55, 67  
Delay composition, 13, 157–158  
Demilitarization, 206–207  
Detection of Explosives, 173–179  
Detonation, 52–54  
Detonation Pressure, 61–65  
Detonation temperature, 37–39, 78  
Detonation wave, 55–61, 67, 78–79  
Diamagnetism based detector, 177  
1,1-diamino-2,2-dinitroethylene (FOX-7), 199

- Differential Scanning  
  Calorimetry (DSC),  
  187–189, 190f
- Differential Thermal Analysis  
  (DTA), 170, 187–188
- 2,4-dinitroanisole (DNAN),  
  182–183, 191f, 202, 203t
- Double base propellant, 9–10,  
  12t, 121, 142–143, 207
- DSC. *See* Differential Scanning  
  Calorimetry
- DTA. *See* Differential Thermal  
  Analysis
- E**
- ECD. *See* Electron capture  
  detector
- Eco-friendly oxidizers, 153,  
  202–204
- Eco-friendly primary explosives,  
  195–196
- Electron capture detector (ECD),  
  174–175
- Emulsion explosives, 94–95, 99
- Energetic binders, 205–206
- Energetic plasticizers, 127, 207,  
  208t
- Energy of formation, 44
- Entropy, 71
- EOS. *See* Equations of state
- Equations of state (EOS), 64,  
  117–118
- Erosive burning, 144
- Exhaust Gas Pressure, 135
- Exhaust velocity, 139
- Expansion ratio, 107, 111–112
- Explosive Storage Houses,  
  3–4
- Explosive train, 81–87, 86f
- Explosive welding, 216–217
- Explosives, 6–7, 71–104
- Explosophores, 8, 74
- F**
- False alarms, 176, 179
- Field ion spectrometer, 177
- Flame temperature, 37–39
- Flash suppressants, 121, 129
- Force constant, 43, 111–112,  
  116, 122t, 141–142
- Fourier transform IR (FTIR), 185
- FOX-7. *See* 1,1-diamino-2,  
  2-dinitroethylene
- Fragmentation, 87–88, 91
- Free energy, 87–88, 91
- Friction Sensitivity, 170, 192,  
  195
- FTIR. *See* Fourier transform IR
- G**
- Gas expansion effect, 77
- Gas generator composition,  
  214–216
- Gas volume, 42
- Gelatine explosives, 97
- Glyceryl trinitrate (NG), 3
- Gun propellant, 10–11, 105–132
- Gunpowder, 1–6
- H**
- Hazard evaluation, 170, 186–187
- Heat content or enthalpy, 22
- Heat of combustion, 27–29, 32,  
  48
- Heat of explosion, 27–29
- Heat of formation, 23–27,  
  33–34, 44, 207–209
- Heat of reaction, 23
- Heat Resistant Explosives,  
  196–197
- HESH ammunition, 89
- Hess's law, 24, 24f
- High density, high VOD  
  explosives, 197–199
- High energy materials, 16t–17t,  
  19–20
- High Performance Liquid  
  Chromatography (HPLC),  
  183–184
- HMX, 9f, 34f, 84–86, 89, 102t,  
  183–184, 209
- HNF. *See* Hydrazinium  
  nitroformate
- HPLC. *See* High Performance  
  Liquid Chromatography
- Hugoniot curve, 58f, 59
- Hydrazinium nitroformate  
  (HNF), 152–153,  
  203–204
- Hydrogen bonding, 84, 127
- I**
- IEDs. *See* Improvised Explosive  
  Devices
- Igniter composition, 157–158
- Illuminating composition, 158, 160
- Impact Sensitivity, 170, 181, 192
- Impetus, 43, 111–112
- Improvised Explosive Devices  
  (IEDs), 173, 174t
- Impulse, 43, 92–93, 138–139
- IMs. *See* Insensitive Munitions
- IMS. *See* Ion mobility  
  spectrometer
- Incendiary composition, 158
- Industrial explosives, 94–100
- Insensitive Munitions (IMs), 199
- Ion mobility spectrometer (IMS),  
  175–176
- IR absorption, 184–185, 185t
- Isochoric flame temperature, 37,  
  80, 112
- K**
- Kieselghur, 4–5
- L**
- Lead azide, 9f, 22, 82, 83t, 195
- Lead free initiators, 195
- Linear burning rate (LBR),  
  54–55, 110, 116–117,  
  142–144
- Liquid oxygen, 136
- Loading density, 28–29, 64, 78,  
  118–119
- Low explosives, 6, 8, 19
- Low vulnerability ammunition  
  (LOVA), 121
- Low vulnerability explosive  
  (LOVEX), 174t
- M**
- Marsh gas, 7, 95
- Mass burning rate, 54–55, 110,  
  142
- Mass fire, 166t, 167
- Mean molar heat capacity, 39
- MEMS. *See* Micro electro  
  mechanical system
- Mercury fulminate, 9, 82, 83t,  
  97, 195

Micro electro mechanical system (MEMS), 178  
 Microballoons, 98  
 Mining, 7, 78, 211  
 Molar internal energy, 39, 39t  
 Monopropellant, 135–136  
 MTNI. *See* *N*-methyl-2,4,5-trinitroimidazole

## N

*N*-methyl-2,4,5-trinitroimidazole (MTNI), 190–191, 202  
 NC. *See* Nitrocellulose  
 Neutral burning, 114, 115f  
 NG. *See* Glyceryl trinitrate; Nitroglycerin  
 NG tablet, 218  
 Nickel hydrazine nitrate (NHN), 195–196  
 Nitrocellulose (NC), 2–3, 4f, 31, 53, 123–124, 181  
 Nitroglycerin (NG), 2–3, 3f, 29f, 53, 121, 135, 207  
 Nitroguanidine (picrite), 9–10, 76, 85t, 121, 129  
 3-nitro-1,2,4-triazole-5-one (NTO), 199, 200t  
 NMR. *See* Nuclear magnetic resonance  
 NQR detector. *See* Nuclear quadrupole resonance detector  
 NTO. *See* 3-nitro-1,2,4-triazole-5-one  
 Nuclear magnetic resonance (NMR), 177, 185–186  
 Nuclear quadrupole resonance detector (NQR detector), 177–178

## O

Obscuration, 13, 158  
 Octanitrocubane (ONC), 5, 5f, 195  
 Oil well perforation, 212  
 Outside Quantity Distance (OQD), 170  
 Overexpanded nozzle, 135  
 Oxygen balance (OB), 29–39, 31f, 34f, 35t

## P

PBX. *See* Plastic bonded explosives  
 Pentaerythritol tetranitrate (PETN), 25–26, 26f, 39–40, 175  
 Permitted explosives, 95, 97  
 PETN. *See* Pentaerythritol tetranitrate  
 Picric acid, 75, 80–81, 85t  
 picrite. *See* Nitroguanidine  
 PIQD. *See* Process Inside Quantity Distance  
 Plastic bonded explosives (PBX), 101–102, 102t  
 Platonizers, 149  
 Polynitrogen caged compounds, 207–209  
 Prills, 34–35, 98  
 Primary explosives, 3, 6, 22, 24, 81–82, 83t, 195–196  
 Process Inside Quantity Distance (PIQD), 170  
 Progressive burning, 113–116  
 Propellant charge mass, 107, 111  
 Propellants, 5–6, 8–12, 10f, 19, 25, 28, 105, 110, 121, 128, 142–143, 202–207  
 Protective garments, 169  
 Pyrotechnics, 11–15, 157, 159–163, 169

## Q

QD Concept, 170–171  
 Quarrying, 2, 99–100, 211–212

## R

RDX. *See* Research and development explosive  
 Red Fuming Nitric acid (RFNA), 136  
 Reduced sensitivity research and development explosive (RSRDX), 199  
 Regressive burning, 115, 114f, 130  
 Relative force (RF), 119  
 Relative Front ( $R_f$ ), 182  
 Relative vivacity (RV), 119

Research and development explosive (RDX), 6, 31, 44, 52, 76, 91, 101, 111, 173, 184, 197, 198t, 199  
 RF. *See* Relative force  
 $R_f$ . *See* Relative Front  
 RFNA. *See* Red Fuming Nitric acid  
 Rocket motor, 133–134, 134f, 150  
 Rocket propellant, 11, 12t, 25, 114, 116, 133–136, 141–148, 148t, 153  
 RSRDX. *See* Reduced sensitivity research and development explosive  
 RV. *See* Relative vivacity

## S

Safety directives, 168–172  
 Scabbing effect, 87, 88f, 89  
 Seat ejection, 218  
 Secondary explosives, 6, 83–86  
 Semigelatine explosives, 97  
 Shaped charge, 6–7, 78, 87, 89–91  
 Shock wave, 41, 54–59  
 Signal composition, 158  
 Single base propellant, 9–10, 121–122, 127–128  
 SIQD. *See* Storage Inside Quantity Distance  
 Slurry Explosives, 94–95, 98  
 Smoke composition, 159–160  
 Smokeless powder, 4–5, 10–11, 105  
 Spark sensitivity, 170, 192–193  
 Specific energy, 43, 79–80  
 Specific impulse, 43, 138–139, 147, 203  
 Spectroscopy, 76, 181, 184–186  
 Storage Inside Quantity Distance (SIQD), 170–171  
 Surface moderants, 130

## T

TACOT, 200t–201t  
 Taggants, 174–175

- TATB. *See* Triamino trinitrobenzene
- Tenderization of meat, 218
- Tension wave, 89
- Tetryl, 84–86, 191–192
- TGA. *See* Thermogravimetric analysis
- Thermal analysis, 181, 187
- Thermally stable explosive, 196–197, 200t–201t, 202
- Thermite composition, 162
- Thermogravimetric analysis (TGA), 187, 189–191
- Thermoredox detector, 176
- Throat area, 146
- Thrust coefficient, 144
- TNAZ. *See* 1,3,3-trinitroazetidine
- TNT. *See* Trinitrotoluene
- Total impulse, 138
- Total thrust, 134, 145
- Toxic Hazards, 169–170
- Tracer composition, 158
- Triamino trinitrobenzene (TATB), 84, 200t–201t
- 1,3,3-trinitroazetidine (TNAZ), 202
- Trinitrotoluene (TNT), 3, 9f, 30–31, 54, 63, 100, 101t, 199–202
- Triple base propellant, 9–10, 121, 129
- U**
- Hazard Classification, 166–167
- Underexpanded nozzle, 135
- Unit of  $I_{sp}$ , 138
- V**
- Velocity of detonation (VOD), 6–7, 36, 54, 59, 62, 77–79, 85t, 181
- Vielle Law, 53, 116–118, 142
- Vivacity, 116, 119
- W**
- Waste Disposal, 163, 167, 172