TRAINING & EDUCATION

TRAINING AND EDUCATION CENTRE

Due to the extensive safety risks connected with handling with explosives, responsible personnel should have a profound knowledge of the properties and safety characteristics of these dangerous materials. Therefore, we offer unique training courses combining theoretical lectures with practical exercises.

These courses are conducted by qualified experts and specialists from academia and explosives industry. The content of each course is tailored in close cooperation with customers to meet all their needs and expectations. We offer all educational levels of the training, both basic and advanced.

OZM TRAINING CENTER
CZECH REPUBLIC

OVERVIEW

We offer comprehensive training courses combining theoretical lectures with practical laboratory exercises. This idea to combine both forms of education allows us to provide a world-class unique experience to our customers.

Our training courses are conducted by qualified experts and specialists from explosives industry and by university professors, who possess extensive experience and long-term research praxis in the field of theory and technology of explosives.

The courses are designed especially for researchers and technologists with only general knowledge of manufacture and application of energetic materials. Young Ph.D. students and scientists at the beginning of their professional career can also take part in them to enhance their expertise and support their further professional growth.

The basic courses will give the participants a comprehensive overview of the field of chemistry and production technology of the whole range of industrially manufactured explosives, theory of explosion and detonation, explosion effects, characterization of energetic materials and safety and risk analysis. We also offer advanced training courses for specific subjects, e.g. advanced interior ballistics, stability of explosives, etc. The list of our basic and advanced courses is given below.

5 DAYS / 40 HOURS

Our training courses are scheduled in five-day blocks (40 hours) and detailed content of each block is tailored in close cooperation with our customers. The philosophy of our courses is to prepare remarkable educational package for the customer's employees, therefore only small group of attendees (4–6) is involved in each block. This ensures the individual approach to each course participant.

THEORY & PRAXIS

Approximately half of the course duration includes a theoretical training and then, in the second half of the course, the participants can personally apply obtained theoretical knowledge during experimental laboratory training. These practical exercises give the participants a great opportunity to quickly improve their knowledge and practical skills to ensure a better understanding of all aspects of handling, processing and applications of explosive materials.

LIST OF TRAINING COURSES

BASIC TRAINING COURSES

1	**Chemistry of Explosives** Working Safely with Chemicals and Explosives, Laboratory Safety ▪ Chemistry of Energetic Materials: Basic Properties and Main Characteristics of Selected Explosive Compounds ▪ Primary Explosives: Main Characteristics and Production of Industrially Produced Primary Explosives ▪ Laboratory Training (Demonstration of Synthesis of Secondary and Primary Explosives, Analysis of Explosives – focused on FTIR, Raman Spectroscopy and HPLC)	5 days
2a	**Propellants – Theory and Technology of Gun Propellants**	5 days
2b	**Propellants – Technology of Ball Powders**	5 days
3a	**Propellants – Technology of Cast Double-Base Propellants**	5 days
3b	**Propellants – Theory and Technology of Pressed Solid Rocket Propellants**	5 days
	Ballistic Cycle ▪ Chemistry of Propellants ▪ Principles of Production ▪ Thermodynamics ▪ Pyrostatics and Basic Interior Ballistics ▪ Chemical Stability of Propellants ▪ Propellant Examination and Testing ▪ Future Trends in R&D of Propellants ▪ Laboratory Training (Calculation of Propellant Thermodynamical Properties, Preparation of Propellant Samples, Dimension Measurements, Density and Bulk Density, Closed Vessel Examination and Burning Rate Examination, Evaluation of Results)	
4	**Primary Explosives** Working Safely with Chemicals and Explosives ▪ Safety in Explosives Laboratories and Personal Protective Equipment ▪ Introduction into Primary Explosives – Properties, Applications, Synthesis and Characterization of: Fulminates (mainly Mercury Fulminate) • Azides (mainly Lead and Silver Azide) • Salts of Polynitrophenols (Lead Styphnate, Lead Picrate, etc.) • Diazodinitrophenol (DDNP) • Potassium Salt of 2,4-Dinitrobenzofuroxan (KDNBF) • Tetrazoles (Tetrazene, Mercury and Copper Salt of 5-Nitrotetrazole, etc.) • Tetrazole Complexes • Nickel Hydrazine Nitrate (NHN) ▪ Perspective Primary Explosives, Development of New Primary Explosives ▪ Technology of Primary Explosives Production, Process Safety, Waste Disposal and Environmental Aspects ▪ Laboratory Training (Synthesis of Primary Explosives – Practical Preparation of Selected Compounds, Characterization of Primary Explosives – Measurement of the Sensitivity to Mechanical Stimuli) ▪ Small-scale Measurements of Detonation Velocity: Theoretical Background of Optical Methods • Sample Preparation and Test Arrangements ▪ Laboratory Training (Real Tests with Small Samples of Plastic Explosive)	5 days
5a	**Theory of Explosion** Basic Principles ▪ Energetics of Explosives ▪ Calculations of Thermochemical Properties of High Explosives ▪ Detonation: General Observation and Real Effects in Explosives ▪ Laboratory Training (Measurements of Detonation Velocity, Measurement of Detonation Front Curvature, OPTIMEX)	5 days

5b	**Explosion Effects** Shock Waves and Detonations ▪ Explosions in Air ▪ Underwater Explosions ▪ Fundamentals of Shaped Charges ▪ Laboratory Training (Measurement of Incident Blast Wave and Determination of TNT Equivalency, Gurney Velocity Measurement, EXPLO5 Calculation)	**5 days**
6	**Technology of Explosives** Working Safely with Chemicals and Explosives ▪ Chemistry of Energetic Materials (Explosophores, Nitro Compounds, Nitramines, Nitrates, Perchlorates) ▪ Primary Explosives (Main Characteristics and Technology of Industrially Produced Primary Explosives) ▪ Technology of Energetic Materials ▪ Laboratory Training (Practical Demonstration of Explosive Charges Casting and Pressing, Demonstration of Preparation of Selected Primary Explosives and High Explosives, Analysis of RDX using DTA, FTIR and Raman Spectroscopy and Chromatography)	**5 days**
7	**Testing of Energetic Materials** Testing Standards and Procedures ▪ Sensitivity ▪ Characterization of Detonation Properties ▪ Stability ▪ Laboratory Training (Impact, Friction and Spark Sensitivity, Thermal Analysis, Stability and Reactivity Tests, Bomb Calorimetry, etc.)	**5 days**
8	**Testing of Gun Propellants and Rocket Propellants** Ballistic Cycle ▪ Chemistry of Propellants ▪ Principles of Production ▪ Pyrostatics and Basic Interior Ballistics ▪ Chemical Stability of Propellants ▪ Propellant Examination and Testing ▪ Future Trends in R&D of Gun Propellants and Rocket Propellants ▪ Laboratory Training (Dimension Measurements, Density, Bulk Density, Calorimetry, Burning Rate and Closed Vessel Examination, Evaluation of Results)	**5 days**
9	**Life Assessment of Propellants** Nitrocellulose and Its Raw Materials ▪ Nitrogen Content and Its Roles ▪ Vulnerability and Stability of Nitrate Esters ▪ Effect of Nitrocellulose Structure on Stability and Vulnerability ▪ Different Types of Nitrate Ester-Based Propellants and Their Performance ▪ Properties of Ingredients Used in Gun Propellants ▪ Chemical Stabilizers and Their Roles, Drawbacks In Propellants ▪ Ballistic Parameters and Their Measurement by Closed Vessel ▪ Low Vulnerability Ammunition Propellants (LOVA) and New Developments ▪ AOP 48 and STANAG for Life Assessment of Nitrocellulose and Propellants ▪ Propellant Ageing, Decomposition Kinetics and Service Life Assessment Using Laboratory Techniques ▪ Techniques Used to Assess Remaining Service and Ballistic Life Backed up by Practical	**5 days**
10	**Theory of Explosive Processing of Metallic and Non-Metallic Materials** Explosive Welding ▪ Explosive Depth Hardening ▪ Explosive Compaction of Powder Materials ▪ Explosive Forming ▪ Other Application of Explosive Processing ▪ Laboratory Training (Demonstration of Explosive Welding and Explosive Hardening, Quality Control Testing)	**5 days**
11	**Safety and Risk Analysis in Explosives Industry** Incident Analysis and Safety Management in Explosive Industry (Incident Cause Analysis – Root Cause Maps, Pillars of Safety Management – Improved Cause Analysis – Practical Safety Management – Practical Exercises) ▪ Risk Analysis in Explosive Industry (Incident Scenarios and Risk – Risk Analysis – Risk Evaluation and Assessment – Simplified Risk Analysis LOPA – Use of Risk Analysis – Practical Exercises)	**3 days**
12	**Explosives Safety and Storage** Explosives Chemistry ▪ Fundamentals of Stimuli That Can Trigger Intended and Unintended Initiation ▪ Classification of Explosives in Respect of Hazard and Compatibility ▪ Health and Safety at Work ▪ PPE and Their Implication ▪ Hazards Associated with Synthesis, Handling, and Storage of Explosives ▪ Accidents Involving in Inappropriate Activities in the Laboratory ▪ The Storage of Explosives Post-research Activities ▪ Small Scale Transportation of Energetic Materials ▪ Disposal of Hazardous Chemicals ▪ Environmental Impacts due to Negligence ▪ Writing Risk Assessment, Safe Operating Procedures and COSHH	**5 days**

ADVANCED TRAINING COURSES

We also offer several specialized advanced training courses for experts from explosives industry, military or academia, focused on selected aspects of energetic materials R&D, production and applications. Detailed content and duration of our advanced courses will be fully tailored according to requirements of each customer to meet all their needs and expectations.

- **Advanced Chemistry of High-Energy Materials**
- **Advanced Optical Measurement of Explosion Parameters**
- **Advanced Stability Testing of Explosives**
- **Analysis of Energetic Materials**
- **Applied Interior Ballistics for Practice**
- **Detonation Physics**
- **Hazard Assessment in Explosives Industry**
- **Mechanical Properties of Propellants**

Other topics upon request.

NOTE: For updates on training courses, please visit **www.ozm.cz/training-and-education**