



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 Research s.r.o.
Bliznovice 32, 538 62 Hrochuv Tynec
CZECH REPUBLIC / European Union
Tel.: +420 469 692 341
Mobile: +420 608 742 777
E-mail: ozm@ozm.cz
www.ozm.cz

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 The Chemistry of Explosive Compounds ■ Secondary Explosives: Basic Properties ■ Primary Explosives: Basic Properties ■ New Energetic Materials ■ Laboratory Training (Synthesis of Primary Explosives, Basic Analysis and Testing of the Selected Explosives)	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 Ballistic Cycle ■ Chemistry of Propellants ■ Principles of Production ■ Thermochemistry ■ 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)	5 days
4	Initiation Technology and Associated Energetic Materials Introduction and Theory of Initiation in Practice ■ Auxiliary Initiators Characteristics and Application ■ Basic Initiators (Non-Electric) ■ Electroexplosive Devices: Main Types ■ Laboratory Training (Demonstration of Different Initiators, Non-Electric Initiation and Detonators)	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, EXPL05 Calculation)	5 days
6	Technology of Explosives Categories of Explosives by Chemical Types ■ Nitro Compounds ■ Nitric Esters ■ Nitramines ■ Primary Explosives ■ Multicomponent Explosives ■ Technology of Manufacture of Selected Explosives and Explosive Charges for both Industrial and Military Applications ■ Laboratory Training (Preparation of Selected Types of Explosive Charges)	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	Characterization of Hazard Properties of Flammable Materials. Gas, Vapor, Dust and Hybrid Mixtures Explosions in Process Industry ■ Introduction into Gas and Dust Explosions ■ Influence of Gas/Vapor Cloud and Dust Cloud Properties ■ Hybrid Mixtures ■ Methods for Measurement of Explosion Parameters ■ Methods for Measurement of Gas Clouds, Flammable Liquid and Dust Cloud Properties ■ Laboratory Training (Testing of Hazardous Properties of Flammable Materials, Ignition Temperature, Minimal Explosive Energy and Concentrations, etc.)	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 Safety in Explosives Laboratories and Industry ■ Risk Analysis ■ Standards and Regulations for the Construction and Operation of Explosives Industry ■ Recommendations and Requirements for Workers	5 days
12	Mining Works and Destruction Blasting Techniques ■ Industrial Explosives ■ Design of Charges ■ Basic Principles of Mining Works ■ Basic Knowledge of Destruction ■ Safety Rules ■ Laboratory Training (Quarry visit, Practice with Chief Blaster – Handling Explosives into Boreholes, Drilling Works – visit, Blasting in a quarry, Analysis of the Blast, Grains of Rock and Visual Inspection)	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.



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