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Basic Pyrotechnics
Decoy Flares – Obscurants & NIR Flares

Participants

The seminar is intended for those involved with the procurement, development, production and research of pyrotechnic countermeasures at governmental agencies, research institutes, manufacturers and testing facilities. The seminar is equally suitable for beginners and those already familiar with the topic.

Seminar location

The seminar is held at the Hotel Burgschänke, Schlossstraße 1, 67661 Kaiserslautern, Rhineland-Palatinate, Germany, http://www.burgschaenke-kl.de/burgschaenke-kl-en.html

Seminar fee

The Seminar fee is 1,850.—EUR plus 19 % VAT and includes a printed documentation as well as soft drinks in the seminar facility.

Registration

Please register no later than November 14, 2025 per e-mail to Lutradyn – Energetic Materials Science & Technology, Burgherrenstraße 132, D-67661 Kaiserslautern, Germany, E-mail: seminars@lutradyn.com ; Tel: ++49(0) 631 3710537

Cancellation

Upon cancellation up to 14 days prior to the seminar a 50 EUR fee will be charged. Cancellations received later effect 25 % charge. No-shows will not be refunded at all.

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Content

- **Physical & Chemical Basisc**

Discussion of the basic chemistry and physics relating to the design and analysis of pyrotechnic compositions and stores. Introduction to the fundamentals of emission and propagation of radiation.

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- **Aerial Infrared Decoy Flares**

Introduction to the “Infrared Threat” to aerial targets and a review of mature and emerging seeker technologies. Discussion of pyrotechnic decoy compositions for blackbody and spectral, kinematic, area, and propelled flares as well as discussion of clandestine pyrotechnic illumination with NIR flare formulations.

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- **Visual- Infrared and Multispectral Obscurants**

Discussion of infrared (NIR, MWIR, LWIR) sensor systems in ground-based theatres and various uses of obscurants in the visual, infrared and millimetric wavelength range. Discussion of pyrotechnic and non-pyrotechnic concepts of aerosol dispersion. Special scenarios like drone countermeasures and one-way transparent obscurants are presented. Red Phosphorus and its use in countermeasures are discussed in detail.

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- **Hazards & Safety of Pyrotechnic Countermeasures**

The particular hazards associated with the production and use of pyrotechnic countermeasures are discussed and safety measures for either area are presented. The Insensitive Munitions (IM) characteristics of typical pyrotechnic countermeasure ammunition is discussed.

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SEMINAR:

„Basic Pyrotechnics”

Decoy Flares – Obscurants – NIR Flares

December 2-5, 2025,
Kaiserslautern, Germany

SEMINAR CHAIR: E.-C. KOCH

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Day 1

- Introduction to Energetic Materials
- Thermochemistry
  - i. Heat of Explosion
  - ii. Heat of Combustion
  - iii. Combustion Temperatures
- Design and stoichiometry of pyrotechnic formulations

Day 2

- Ignition and Propagation
- Emission of Radiation
  - i. UV & Visual
  - ii. Near Infrared
  - iii. Mid Infrared
- Propagation of Radiation
- Absorption
- Scattering

Day 3

- Aerial Targets as Infrared Sources
- Seeker Technology
- Basics of Flare compositions
- Black Body Flare Formulations
- Spectrally Adapted Formulations
- Nose Cones
  - i. High Density flare material
- Propelling Formulations
- Area Formulations
  - i. Red Phosphorus
  - ii. Solid Pyrophorics
- Special Spectral Purpose Decoys
- NIR Illumination
  - i. State of the Art
  - ii. Next Generation

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Day 4

- Mid and Longwave Infrared Sensors
  - i. Land based systems
  - ii. Dual mode sensors
- Basics of pyrotechnic obscurants
- Visual Obscurants
- Infrared Obscurants
- Millimetric Obscurants
- Special Scenarios
  - i. Drone Countermeasures
  - ii. Unidirectional Obscurants
- Red Phosphorus based Countermeasures
- Hazards and Safety of Countermeasures
  - i. Production
  - ii. Testing & Use
  - iii. Health Hazards
  - iv. Insensitive Munitions response of Countermeasures

The lecturers

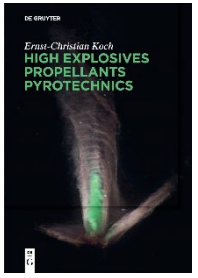
Dr. habil. Ernst-Christian Koch, FRSC studied chemistry at the RPTU Kaiserslautern, Germany obtaining his diploma in 1993 and his doctorate in 1995. Following basic military service with the Nuclear, Biological, Chemical Protection Centres of the German Armed Forces at Sonthofen (ABC/SeS) and Munster (WIS) Dr. Koch became Head of Development at the Göllheim Pyrotechnics works (Piepenbrock, Comet) in 1997. From 2002-2004 he worked for Diehl Munitionssysteme and Diehl BGT Defence. In mid-2007 he was appointed Technical Specialist Officer at NATO Munitions Safety Center (MSIAC) at NATO Headquarters in Brussels and joined NATO in January 2008. Following his departure from NATO in 2013 Dr. Koch held a position as Senior Lecturer in Defence Chemistry at the Defence Academy of the United Kingdom in Shrivenham until 2015. Dr. Koch obtained his *venia legendi* in 2024 and serves as Privatdozent at RPTU Kaiserslautern, Germany. Dr. Koch founded Lutradyn in 2015.

Dr. Ing. Sebastian Knapp studied physics at the universities

of Heidelberg and Freiburg im Breisgau and received his diploma in 2010 for his work on the spectroscopy of metal combustion. He has been working as a scientist at Fraunhofer ICT in Pfinztal since 2010 and has been head of the "Combustion and Pyrotechnics" working group since 2019. He has specialized on the interpretation and modeling of UV-VIS spectra of small molecules, the oxidation of metals and the development of combustion models for pyrotechnic mixtures and rocket propellants. He obtained his doctorate from the Karlsruhe Institute of Technology (KIT) in 2025 for his dissertation on particle modeling of thermites.

Recommended Topical Reading

Metal Fluorocarbon Based Energetic Materials 2012. Wiley-VCH, XVIII + 342 pages, ISBN 978-3-527-32920-5



High Explosives Propellants Pyrotechnics 2021, Walter De Gruyter, XXIV + 759 pages, ISBN 978-3110660524.