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FRAUNHOFER INSTITUTE FOR CHEMICAL TECHNOLOGY ICT


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1 *Production of energetic materials in remotely-controlled continuous processes.*
2 *Particle coating in a fluidized-bed coater.*

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ENERGETIC MATERIALS FOR DEFENSE ENGINEERING

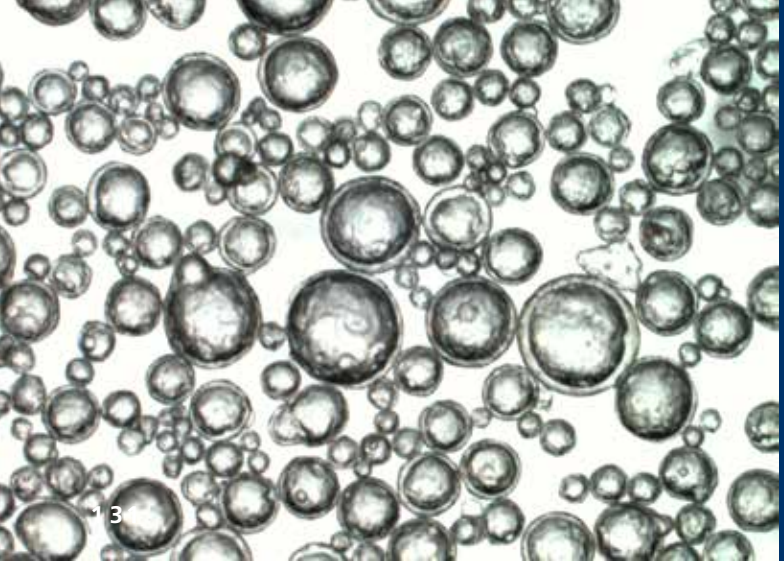
The Energetic Materials Department at the Fraunhofer ICT is concerned with all aspects of the development, production and application of propellants and explosives. Research is focused on the development of new propellants and explosive compositions, and on their processing, production and application in high explosives, rocket propellants, gas generators, gun propellants and pyrotechnic compositions. The research and development work includes comprehensive chemical characterization and quality assurance, aging and service life analysis, and the development of resource-efficient, environmentally-friendly systems and technologies meeting health and employment legislation.

Key aims include:

- Ensuring the decision-making competence of the German Federal Ministry of Defence
- Research and development for the defense industry
- System capability, spanning the entire manufacturing chain from raw material to prototype
- Internationally-coordinated research and development, for example in the context of the European Defence Agency and NATO.

New components and additives

The synthesis of explosives generates new, energetic substances for solid propellants, high explosives, gun propellants and pyrotechnic components, as well as for security research.



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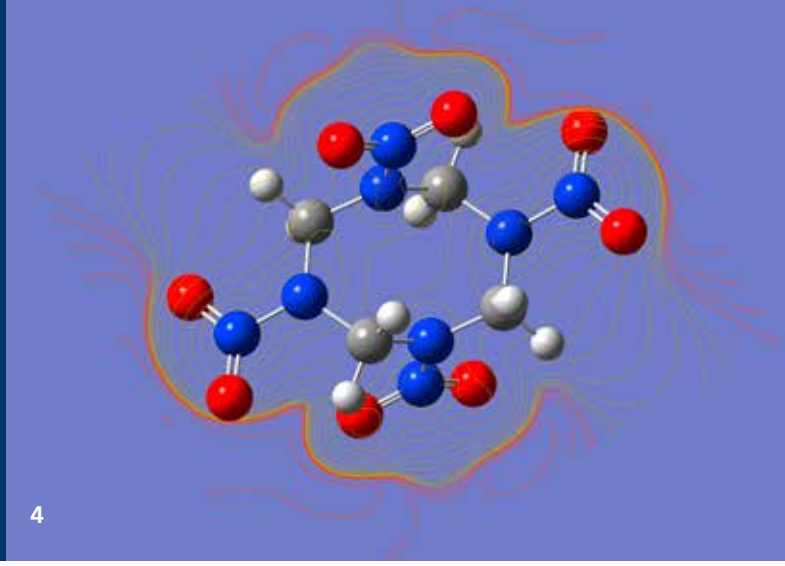

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It ensures an independent supply of energetic substances for research and development work. Products include energetic binders, plasticizers and energetic ionic liquids.

Microreaction technology

This technology enables continuous synthesis with high process safety and precise isothermal process control, for example for the optimization of highly exothermic or mixing-sensitive processes such as nitrations, oxidations, esterifications or azidation reactions. On a pilot plant level, nitrate esters such as NGL, BTTN, EGDN or methyl nitrate are synthesized in remotely-controlled processes according to safety requirements, with high product quality.

Rocket propellants / gel propellants

High-performance propellants for modern rocket motors are developed in a pilot plant, including CDB, nitramine, composite and gel propellants. The underlying aims are a low signature, low sensitivity and vulnerability (LOVA) or low-noise underwater propulsion. Gel propellants enable a controllable thrust. This can be used for example for missiles that carry out a slow-flying search until they identify their target, and then approach it rapidly with an amplified thrust. The rheological properties of gels fall between those of liquids and solids. Gel propellants therefore combine the advantages of solids, for example in terms of storage, with the dosability of liquids on injection into the combustion chamber. Research in this field is integrated into a national gel technology program, and covers all aspects up to initial free-flight tests.

Tailored explosive particles

In the research group for particle technology, energetic components are refined on a pilot level and tailored to meet the specific requirements placed on propellants or explosives. For example, explosives are coated in a fluidized-bed coater, spherical ADN prills are crystallized from the emulsion, and ammonium nitrate is stabilized with additives in a spraying process, e.g. for the rocket propulsion unit of the Ariane 5 rocket.

Explosives

Insensitive, high-performance explosives are developed using new, energetic components. Examples include explosives with a low sensitivity in pressed charges, cast cured PBX, plastic explosives, scalable charges or underwater explosives. The aim is, for example, to develop future high-performance explosives for supersonic penetrators, or to improve shaped charges.

Gun propellants / caseless ammunition

Propellant powders with temperature-independent combustion are produced on a pilot scale for guns of different calibers, and foamed propellant structures are developed for caseless or lightweight munition. The propellants can be produced in a pilot unit in almost any geometry.

Safety and security research

Beside defense applications, we are also carrying out research in the field of civil security and safety. Current research topics include explosives detection, home-made explosives, molecule-specific sensor coatings, gas generators for airbags and underwater rescue systems as well as coatings for the fire protection of ammunition. A test center for explosives detection systems is operated in the field of aviation security on behalf of the German Federal Police.

1 *Coated ADN prills.*

2 *Simulation of an HMX molecule.*