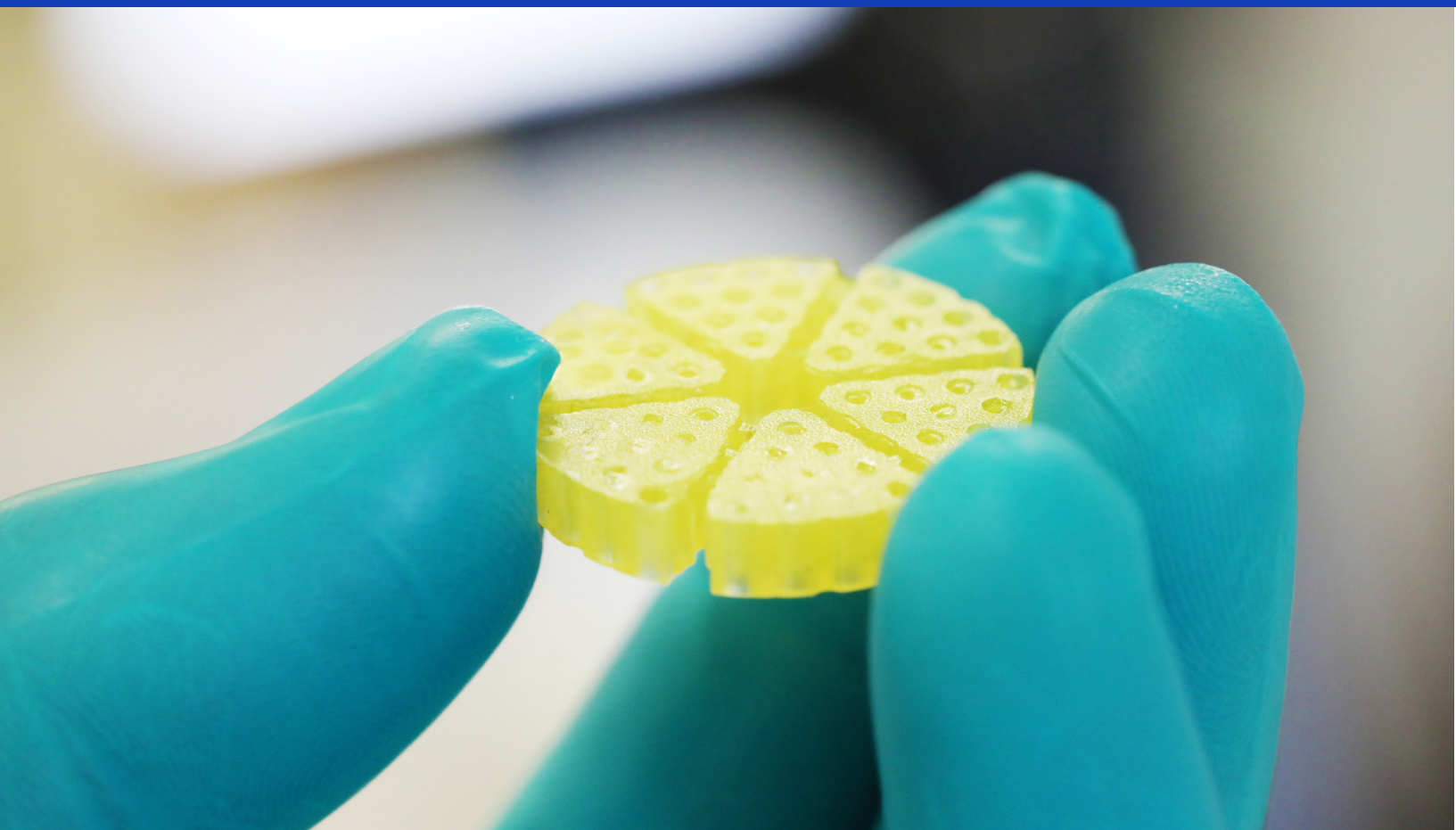


Propellants, Processing & Pyrotechnics



Innovation in propellants and pyrotechnics

Propellants, Processing and Pyrotechnics (3P) is a product team within TNO's Energetic Materials department. Our multidisciplinary team specializes in process innovation and in modelling, developing and testing customized products. We have the resources and qualifications to support governments and the chemical and defence industry, so your organization can innovate in propellants and pyrotechnics.

Facilities and experience

The facilities of TNO's Energetic Materials (EM) department include test banks, laboratories and bunkers for (gas) explosions. They are built for the synthesis, analysis and handling of energetic materials. Over decades of work with explosive and toxic materials, such as pyrotechnics, organic peroxides, ammonium nitrate fertilizers, self-reactive and self-heating substances, and flammable gases, solids and liquids, the department has built strong expertise and a safe track record.

Propellants: towards customization

The industry keeps asking for better products, so we stay at the front of propellant development. We pioneered continuous extrusion as a production method for gun propellants. Compared with batch production by ram extrusion, it is intrinsically safer, because less material is processed at any time. It also allows finer control of the process, which gives a higher-quality, more standardized product. This expertise led to a solventless propellant process and more environmentally friendly products.

Case study: co-extrusion

We developed co-extrusion, which makes coated propellants possible. A coating can make the propellant perform more consistently over a wide range of ambient temperatures. It can also make the gases cooler and less corrosive, which extends barrel life. Our in-house modelling covers everything from designing a propellant for the desired pressure curve to optimizing ingredients and mixing.

Processing: 3D printing

New applications of energetic materials need new production processes. 3D printing is common in many fields, but not yet for energetic materials. We are changing this with help from 3D-printing experts elsewhere in TNO, and have adapted the process for energetic materials. For example, we built print heads that measure temperature and pressure for safety monitoring. This work creates an enabling technology for future ammunition, with more customization and a better sustainability profile.

Case study: 3D-printed propellant

3D printing removes most limits on the shape of gun and rocket propellants. TNO was the first in the world to fire a gun using a 3D-printed propellant. We now work on propellants with variable properties, by changing the composition during printing. This allows extensive tuning of performance: for example, a missile that starts fast, slows to a cruising speed and accelerates again towards the target.

Processing: control

Besides the demand for more innovative propellants and ammunition, there are more reasons to improve production. Moving from batch to continuous production gives much more control, which makes it easier to make unique, high-quality products in the quantity you need. It is also safer and needs less overhead for around-the-clock production.

Case study: on-demand nitroglycerine

Producing, transporting and storing nitroglycerine (NG), an additive in gun propellants, is expensive because of strict safety requirements. Producing it on-site and on demand, as part of propellant production, removes the need for intermediate transport and storage. This lowers costs and opens the way to safer, more sustainable options. To support this shift, we developed Modular Autonomous Production Systems (MAPS). Ask us about them.

Pyrotechnics: cleaner fireworks

Even an old technology like fireworks leaves room for innovation. A client wanted fireworks with a smaller environmental impact. Using our knowledge of the full range of energetic materials, we developed a new type of pyrotechnic composition. It burns much cleaner, so only a fraction of the heavy metals is needed to create the bright colours that fireworks are known for.

What you get

Our clients, from SMEs to multinationals and governments, value our rapid response, independence and extra effort. Every project ends with the results and a thorough interpretation, always answering one question: what does this mean for your business?

3P at a glance

- Continuous extrusion of gun propellants, pioneered by TNO
- Co-extrusion of coated propellants
- Solventless propellant processing
- 3D printing of energetic materials with in-line safety monitoring
- On-demand production with MAPS
- Cleaner pyrotechnic compositions

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