

# Nanostructured energetic materials: opportunities to enhance performances

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The nanostructuring of materials is currently penetrating most of the scientific and economical domains. The energetic materials are fully impacted by this revolution. Energetic materials such as explosives and thermites are currently nanostructured to enhance the performance of their classical micron-sized counterparts. These higher performances may include high combustion velocities and the possibility to design smart energetic materials by adjusting precisely the structure of the materials and this on the required local scale. The high potential of these materials is timely with the current requirement to replace lead-containing igniters, to be able to miniaturize detonators and also to develop bigger energetic charges as the production capacities of freshly designed techniques are currently scaled up.

Different examples such as nanostructured explosives and nanothermites will be shown and the performance enhancement will be discussed, in terms of combustion rates, desensitization and reliability. New processes to engineer these nanosized energetic nanocomposites will also be described. As an example, the Spray Flash Evaporation (SFE) process to design high performance nanostructured explosives will be discussed (fig. below), its versatility and potential in other domains such as medicine will be shown. Finally, the possibility to use nanostructured energetic materials to synthesize ultra-small particles, such as for example ultimate-sized nanodiamonds or nanooxides, will also be presented. This new synthesis route is a powerful alternative to classical synthesis chemistry when the objective becomes to reduce drastically the sizes of the desired nanoparticles, and this for various purposes.

## Figures



Figure 1: Spray Flash Evaporation (SFE) pilot plant.