



The **French-German Research Institute of Saint-Louis (ISL)** situated in the border triangle of Germany, France and Switzerland is an internationally renowned research institute belonging to a global industrial and economic network. The spectrum of our core activities comprises a variety of topics: aerodynamics, energetic and advanced materials, lasers and electromagnetic technologies, protection, security and situational awareness. Our activities are related to both basic and applied research.

ISL is offering a **PhD Position**

Keywords: Nanothermite, Explosive, Pyrotechnics, Spray Flash Evaporation and Synthesis, Combustion, Detonation

Use of Spray Flash Evaporation (SFE) and Synthesis (SFS) processes to prepare combustible and detonating hybrid energetic materials of NSTEX-type and their components

Context

The NSTEX (NanoStructured Thermites and EXplosives) are hybrid composite energetic materials, with detonating properties which make them particularly promising to replace lead-based primary explosives in detonators, but also to develop new domains of applications for high explosives. NSTEX are currently prepared by a two steps process which leads to micron-sized cookies, in which nanothermite components are enclosed in the organic matrix formed by the crushing of explosive submicron-sized particles.

Goals of the thesis

The main objective of this PhD research will be to formulate NSTEX in a single step, by mixing their components thanks to the Spray Flash-Evaporation (SFE) process. The first step will be to identify a liquid or a mixture of liquids allowing both to disperse the nanothermite components and to dissolve the explosive. The second step will be the preparation of several NSTEX compositions by the SFE process. The third step will be the morphological characterization of the materials obtained by the techniques available in the laboratory and at the ISL. The fourth step will be the study of the detonation properties of the NSTEX prepared by SFE, with a special focus on the distance of transition and on the detonation velocity. The last step will be to compare the properties of the NSTEX prepared by the SFE process with those of NSTEX formulated by simple physical mixing.

The secondary objective of this PhD is a more exploratory research, which will be to use the Spray Flash Synthesis (SFS) process to synthesize components of NSTEX such as the oxidizer which enters the composition of the nanothermite, or even the nanothermite itself.

The overall objective of this PhD research is to bring an experimental confirmation to the interest of using SF processes for preparing NSTEX and to better understand the relationship between their detonating properties and the way their components are arranged.

Candidate profile

- ◆ Master's degree in Chemistry, Physics or Material Sciences
- ◆ Fluent English, French or German in speaking and writing
- ◆ Scientific curiosity, initiative, reliability, teamwork and communication skills

Benefits

- ◆ Ph.D. degree in chemistry and physics in one of the most renowned laboratory in the domain of energetic materials
- ◆ Multidisciplinary environment
- ◆ Competitive salary

Localization

This thesis will be held at French-German Research Institute of Saint-Louis (ISL).

French-German Research Institute of Saint-Louis (ISL)

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