



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: Energetic materials, Spray Flash Evaporation, Multifluid systems**

## Assembly of heterogeneous and organized energetic compounds by Spray Flash Evaporation

### Context

Energetic materials, which are crystalline materials with energetic properties and usually range in size from a few to several hundred micrometers, are likely to be sensitive and therefore present handling and transportation risks. In order to correct this main drawback, these materials are reduced in size, mixed with additives such as graphite, polymers in order to obtain low-sensitivity explosives. The aim of this thesis is to improve their sensitivities (to shock, electrostatic discharge, friction and/or impact) and mechanical strength while maintaining or improving their energetic properties by elaborating heterogeneous compounds under Spray Flash Evaporation.

### Goals of the thesis

The manufacturing processes usually used to design such compounds do not guarantee a safe handling of the products and to produce sub-micrometer size particles in a continuous way while controlling finely the assembly of the desired energetic compound in terms of material quantity, shape, arrangement or crystallinity. Among these processes, the versatile SFE (Spray Flash Evaporation) process is able to address most of these issues. Nevertheless, it remains limited in the design of heterogeneous energy materials due to its configuration and still mainly used in the development of single-component materials. Consequently, the main purpose of this thesis will focus on the development by SFE of innovative energetic materials with complex and organized structures by using multifluidic systems. The student will also focus on

the understanding of the formation mechanisms of heterogeneous energetic nanoparticles under Spray Flash Evaporation and on the correlating between the physico-chemical properties of the spray and of the particles. This multidisciplinary thesis will address different scientific aspects including: materials science, coupling and surface chemistry of droplets, physico-chemical characterization of energetic materials, and the physico-chemical study of the droplet evaporation under vacuum.

### Candidate profile

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

### Benefits

- ◆ Ph.D. degree in the domain of chemistry and physics
- ◆ Multidisciplinary environment
- ◆ Competitive salary

### Localization

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

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

Dr. Guillaume THOMAS/ Dr. HDR Denis SPITZER – Physics and chemistry of energetic nanomaterials  
5 rue du Général Cassagnou – 68301 Saint-Louis – France  
[guillaume.thomas@isl.eu](mailto:guillaume.thomas@isl.eu) – tel : +33 (0)3 89 69 58 72  
[denis.spitzer@isl.eu](mailto:denis.spitzer@isl.eu) – tel : +33 (0)3 89 69 50 75

