

# Safety Guidelines and Code of Conduct for responsible Research

*NEO is a research team who carries out interdisciplinary research in nano-energetic materials at the highest international quality level. We clearly aim -by creating new knowledge- improve quality of life and enhance the security of each citizen. Consequently, NEO has the responsibility to ensure that its research environment and researchers adhere to some important values and follow good practices in research as defined in European Charter for Researchers. This document is provided to foster responsible research and ensure safety of each researcher working with us.*

## SAFETY GUIDELINE WHEN SYNTHESIZING AND MANIPULATING NANOTHERMITES AND PYROMEMS

Nanothermites are energetic substances which are stable below 300 °C. However, they could –under certain conditions- undergo chemical change with sudden liberation of energy. This could pose hazards to health and materials if they are not used in right manner and controlled situations. Safety rules need to be strictly followed depending on the type of materials (mixture of nanopowders or foils).

PyroMEMS are small devices that contains energetic mixtures inside or onto it, in order to perform mechanical or thermal actions.

### Mixtures of metal and oxide nanopowders

1. The nanopowders, metal and metal oxides, after being purchased, must be declared to C. Blatché (05 61 33 78 05) or S. Assié-Souleille (05 61 33 78 94). **They must be stored hermetically** and importantly, the **metal nanoparticles must not be stored in the same tubes as Oxides nanoparticles**.
2. It is prohibited to prepare more than **10 mg of nanothermite by batch**.
3. It is strictly **prohibited to store nanothermite in dry form** (which is the reactive one). The storage must be done in hexane or other solvent.
4. It is strictly **prohibited to store nanothermite in an office**.
5. During nanopowders manipulation, you must wear glasses, overall, gloves and **antistatic wrist**.
6. Nanothermite must be prepared only for your experimentation purpose and the **unused powder must be destroyed**, burned or eliminated by accredited society, in order to prevent potential misuse.

*Any questions in relation with nanopowder: refer to C. Blatché or S. Souleille.*

*Any question in relation with nanothermite reaction or sensitivity : refer to C. Rossi*

### Magnetron-sputtered Al/CuO nanofoils

1. The nanofoils can be only sputtered-deposited on a glass, silicon or ceramic substrate. If – for experimental purposes (DSC analysis for example)- released foils are necessary, please refer to C. Rossi before.
2. There are safety rules in the clean room regarding the sputtering equipment producing Al/CuO multilayers.
3. The layers' stacking takes place only on the substrate and substrate holder and not on the chamber wall. The safety precautions are therefore at the end of the process, i.e. when the substrate holder (metal plate) and the wafers (positioned on this holder) are taken out of the chamber, and put in the air. **Only Severine Vivies** (05 61 33 79 32) **and Ludovic Salvagnac** (05 61 33 79 33) can run the sputtering equipment and can load off the samples after the nanofoils were deposited on it.
4. Before touching the sample holder, it is important to be connected to the ground to prevent electrostatic discharge.
5. After having retrieved the samples with nanofoils on them, the samples holder must be immersed in an acid bath to dissolve the remaining multilayers before restarting a deposition process.

*Any questions in relation with sputtering process and equipment : refer to L. Salvagnac or S. Vivies .*

*Any question in relation with nanothermite reaction or sensitivity : refer to C. Rossi*

## GUIDELINES WHEN CHOOSING AND MANIPULATION CHEMICALS

It is important to use and work with chemicals and materials that are REACH compliant. (<https://www.ecologique-solidaire.gouv.fr/reglementation-reach#e3>).

All the reactants, materials (oxide, metal, chemical cues, ...) and chemical chosen to conduct your research must be totally harmless to humans, animals and environments. **Do not manipulate and store dangerous products. Do not waste chemicals and nanoparticles into the environment.**

Refer to [ap@laas.fr](mailto:ap@laas.fr) for any questions.

## CODE OF CONDUCT TO REMOVE ALL RISKS OF MISUSES OF YOUR RESEARCH AND RESULTS

1. All the samples produced for experiments during your project/research must be destroyed after the publication of the results.
2. All the dummy and test materials that are produced to set up the right deposition parameters in any process and technique will be thrown immediately.
3. If you suspect that some of your data or knowledge or devices can be potentially misused in weapons context or for criminal or terrorist activity, refer to your advisor (C. Rossi or A. Esteve) and importantly do not publish it.
4. Each September, summarize the highlights of your research (in terms of process, materials, devices) and send them to [neo-eb@laas.fr](mailto:neo-eb@laas.fr). They will be reviewed by an ethic board annually.

Refer to C. Rossi or A. Esteve for any questions.

## KEEP AWARE OF RESEARCH MISCONDUCT AND AVOID OTHER UNACCEPTABLE PRACTICES

1. It is totally forbidden to fabricate, falsify, or do plagiarism in proposing and performing research, or in reporting research results.

**Fabricate results** is making up results and recording them as if they were real.

**Falsification** is manipulating research materials, equipment or processes or, omitting or suppressing data or results without justification.

**Plagiarism** is using other people's work and ideas without giving proper credit to the original source, thus violating the rights of the original author(s) to their intellectual outputs.

2. It is strictly forbidden to manipulate authorship or denigrate the role of other LAAS or partners researchers in publications.
3. It is strictly forbidden to diffuse results that were partially or totally conducted in LAAS without referring to C. Rossi or A. Esteve. Even after the end of your contract.

Refer to C. Rossi or A. Esteve for any questions.

## RELATED DOCUMENTS TO CONSULT

The European Code of Conduct for Research Integrity, European Science Foundation, [https://ec.europa.eu/research/.../h2020-ethics\\_code-of-conduct\\_en...](https://ec.europa.eu/research/.../h2020-ethics_code-of-conduct_en...)

Ethics and data protection, European Commission, [https://ec.europa.eu/.../data/.../ethics/h2020\\_hi\\_ethics-data-protecti..](https://ec.europa.eu/.../data/.../ethics/h2020_hi_ethics-data-protecti..)

Guidance note — Research involving dual-use items, [ec.europa.eu/research/.../data/ref/.../guide\\_research-dual-use\\_en.pdf](https://ec.europa.eu/research/.../data/ref/.../guide_research-dual-use_en.pdf)

Règlementation REACH, <https://www.ecologique-solidaire.gouv.fr/reglementation-reach>

Date

Place

Signature