SCINTILLATING THIN-FILMS TO CHARACTERIZE TRIBOELECTRIC EFFECT

LABORATORY : Institut Lumière Matière
IN COOPERATION WITH : iLM - Michelin

LEVEL : M2
TEAM(S) : LUMINESCENCE

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KEYWORD(S) : scintillation / triboelectricity / rubber

SCIENTIFIC CONTEXT :

Triboelectricity, which enables the generation of opposite charges when two materials of different natures are rubbed against each other, or simply brought into contact and then separated, remains a complex phenomenon that is still the subject of fundamental research.(1) Charge separation following contact may notably be accompanied by the emission of energy in the form of electrons or photons, with energies potentially extending into the X-ray range.(2)

If one of the materials used in a triboelectric experiment is capable of converting such ionizing radiation into visible photons, the resulting light emission can be strongly enhanced. This is precisely the role of a scintillator material. We have recently demonstrated that visible light emission, observable with the naked eye, can be generated simply by rubbing a film of copper-doped zinc sulfide (ZnS, used here as the scintillator material) against a polymer, in this case PDMS (see Figure).

Following this proof of concept, we now aim to gain a deeper understanding of the phenomenon, investigate the parameters governing the light emission, and apply this indirect method for probing the triboelectric effect to materials of industrial relevance, in particular model tire-rubber compounds, in collaboration with Michelin. We will specifically investigate different surface chemistries in order to optimize the “rubber/substrate” triboelectric pair and maximize light emission.(3,4)

MISSIONS :

The intern will contribute to the development and optimization of the experimental setup, including:
- Preparation and shaping of the materials (rubber samples, scintillator, substrates);
- Deposition by PLD (pulsed laser deposition) of various surface coatings designed to tune the triboelectric effect (TiO_2, SiO_2, ZrO_2, PTFE, etc.);
- Development of a suitable experimental measurement setup;
- Data analysis and modelling.

Research environment
The internship will be carried out at the Institut Lumière Matière, within the Luminescence group. The group brings together researchers with complementary expertise in materials synthesis and materials science, optics, and scintillation, providing an environment particularly well suited to the interdisciplinary nature of the project.

Candidate profile
We are looking for a student with an interest in interdisciplinary research and a background in physical chemistry and/or materials science.

OUTLOOKS :

Depending on the results obtained, the project may be continued as a PhD thesis.

BIBLIOGRAPHY :

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published on 06/10/2026