FLUORESCENT NANOSENSORS FOR IMAGING STRESS IN COMPOSITE MATERIALS

LABORATORY : Institut Lumière Matière

LEVEL : M2
TEAM(S) : LUMINESCENCE
LIQ@INT

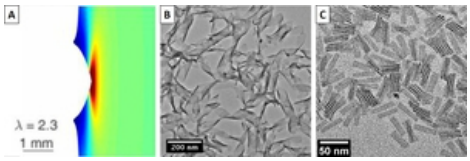
CONTACT(S) : LEOCMACH Mathieu
MAHLER Benoit

CONTACT(S) DETAILS: mathieu.leocmach[at]univ-lyon1.fr / Tel. 0472448070
benoit.mahler[at]univ-lyon1.fr / Tel. 0472431130

KEYWORD(S) : Nanoparticle / fracture / mechanics

SCIENTIFIC CONTEXT :

The fracture of **heterogeneous materials** (composites) remains poorly understood. It is known that diffuse damage of the material occurs at scales comparable to the microstructure before eventually leading to the nucleation and growth of macroscopic fractures. To better understand damage and microstructure interact (weak point, sacrificial dissipation), it is necessary to move from a macroscopic view (Fig~A) to a **microscopic picture of stresses during fracture**.



A) Stress map during fracture. B) CdSe nanoplatelets D) stacks of nanoplatlets

MISSIONS :

The aim of this internship is to develop fluorescent emitters based on semiconductor nanoplatelets that can be dispersed in a polymer matrix which is itself heterogeneous, and whose emission will depend on local stresses (intensity, orientation). The observation of these **nanosensors** by **confocal microscopy** (image analysis) coupled with mechanical tests will allow to characterize their sensitivity and, eventually, to better understand the rupture. Two types of nanosensors will be developed in parallel, based on one hand on nanoplatelets that can be unfolded under stress (Fig B) and on the other hand on stacks of coupled nanoplatelets (Fig C) sensitive to the distance between plates.

This multidisciplinary project will combine nanocrystals synthesis, electronic and optical microscopy, and optical spectroscopy of composites under stress.

OUTLOOKS :

This internship can lead to a **fully funded PhD thesis** (ANR).

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