

Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : MAURER Given names : Thomas

Status (prof., assistant prof., ...) : Professor

Laboratory : Institute Charles Delaunay (ICD), Light, nanomaterials, nanotechnology (L2n) Website address : <http://lnio.utt.fr/fr/index.html>

Institution : University of Technology of Troyes (UTT) Website address : <http://www.utt.fr/en/index.html>

Scientific competence of the supervisor:

Thomas Maurer is professor at the L2n (UTT) and is the scientific responsible of the Smart Sensors workgroup of the ACTION Laboratory of Excellence (<http://www.labex-action.fr/en>) whose aim is to integrate smart functionalities into matter. For the past few years, he has developed his research activity at the frontier between nano-optics and mechanics with the aim to develop color-changing strain sensors taking advantage of plasmonic nanoparticle properties. This project will be co-directed with M. Fleischer from Tübingen University in Germany, who specializes in plasmonics, a branch of physics dealing with the nanofabrication and properties of metallic nanostructures.

Two major publications in the field proposed for the PhD :

1. The beginnings of plasmomechanics: towards plasmonic strain sensors
T. Maurer et al., *Frontiers of Materials Science*, 9 (2), 170-177 (2015)
2. Dense Brushes of Tilted Metallic Nanorods Grown onto Stretchable Substrates for Optical Strain Sensing
J. Marae-Djouda et al., *ACS Applied Nano Materials*, 1(5), 2347-2355 (2018)

Website address of the personal page : M. Fleischer: <http://www.uni-tuebingen.de/plasmonics>

Supervisor's email : thomas.maurer@utt.fr, monika.fleischer@uni-tuebingen.de

Description of the research work proposed for a PhD Topic # (see list) : IV-2

Title : Mechanoplasmonics and perspectives of applications for flexible plasmonics

Subject :

This project is based on a collaboration between UTT and the University of Tübingen (Germany). The PhD student will be co-supervised by Thomas Maurer (UTT) and Monika Fleischer (Tübingen) and will receive a joint PhD diploma from both universities. Flexible plasmonics is currently a hot topics which should lead to the development of numerous applications. One of them concerns mechanoplasmonics and the possibility to design colour-changing elastomers for strain sensing (see publications: T. Maurer et al., *Frontiers of Materials Science* 9 (2), 170 (2015) and J. Marae-Djouda et al., *ACS Applied Nano Materials*, 1 (5), 2347 (2018)). Current technological breakthroughs can be achieved from the transfer of metallic nanostructures onto flexible substrates (see F. Laible et al., *Nanoscale* (2018)). Two strategies will be followed: 1) the direct transfer of metallic nanostructures with different defined shapes prepared by electron beam lithography onto elastomeric substrates in Tübingen, and 2) the deposition of gold nanoparticles onto elastomeric substrates via self-driven evaporation (Smart Force technology) in Troyes. The subsequent characterization (SEM, AFM, optical spectroscopy) and numerical modelling will be performed both in Tübingen and Troyes. The major scientific objective is to fully understand plasmonic coupling for variable nanometric gaps, while the technological goal is to develop colour-changing strain sensors.

Keywords :

mechnoplasmonics, plasmonic coupling, metallic nanoparticles, strain sensors

Expected collaborations :

Collaborative project between UTT (France) and University of Tübingen (Germany). The PhD student will spend 2 years at Tübingen and 2 years at UTT.

Background required from the applicant :

Engineering degree or master degree in (solid state) physics, optics or nanotechnology. A solid knowledge in physics, in particular optics and electromagnetism, is expected. Experience in chemistry is also welcome. The subject will be mainly experimental so the applicant should be able to conduct experiments and analyse the data.

Existence of a PDF file detailing the proposal ("yes" or "no") : no

(see guidelines on the website www-csc.utt.fr)