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## Nanogauges for integration of strain sensors integrated into matter

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or the past twenty years, nano-optics has emerged as a promising research field; thanks to huge progress in nanofabrication and offers great technological potential for applications in fields such as biology, medicine or chemistry. Coupling between plasmonic nanoparticles (NPs), well-known as the plasmon ruler equation, was recently investigated by fabricating arrays of NP dimers with various inter-particle distances using e-beam lithography. In this talk, we aim to illustrate how it should be possible to break through frontiers between mechanics and plasmonics in the next future by showing our first results on the use of gold nanogauges for strain investigation as well as recent advances published in the literature. We will first illustrate how SEM tracking of Au NP displacements allows mapping strain tensor components at the nanoscale and bring information which is not currently achievable by other conventional techniques. Then we will expose advances which have been recently achieved in the literature concerning the potential of plasmonic NPs to develop color-changing materials and strain sensors integrated into matter. In particular, we will focus on two inherently disordered systems made either of Au NPs or Au nanorods (NRs) grown onto PDMS substrates which exhibit material coloration due to the Au NPs strong light absorption. Thanks to an optical extinction set-up with implemented traction micromachine, plasmonic coupling between the gold nanoparticle assemblies may be observed and compared to nanoparticle displacements (see Figure 1). The long-term objective of such work is the development of a new generation of plasmonic strain sensors. Finally, we will propose perspectives of research axis in this field in order to seize the opportunity of this talk to build up collaborations. In particular, we will focus on the need of ability to develop nanofabrication routes of NP ordered arrays or nanorings onto elastomeric substrates.



Figure 1: Optical extinction spectroscopy performed with in-situ mechanical tests and/or angle-resolved measurements allowed revealing both intriguing optical properties of Au nanorods brushes as well as their potential for strain sensing.

## **Biography**

Thomas Maurer is an Assistant Professor at the University of Technology of Troyes. He has been developing a research activity at the interface of nanotechnology, mechanics and optics, which can be designed as mechanoplasmonics. In parallel, he is a member of the Action Laboratory of Excellence Executive Committee and responsible of the 'Smart Sensors' scientific work group whose aim is to integrate sensing functionalities into matter.

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