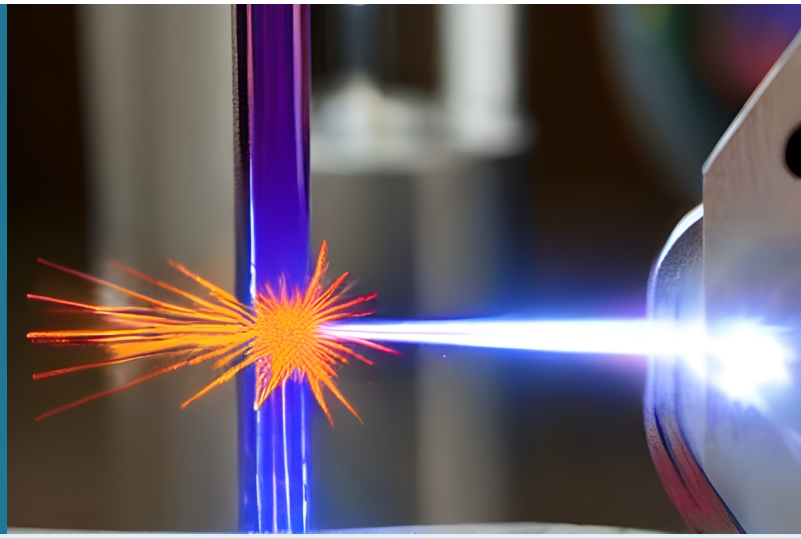
PROJECT FACTSHEET

www.list.lu/en/research/project/nanobynano/?no_cache=1&cHash=20dd09c8a1012304a07c61644b500449

NANObyNANO

Elucidating and understanding NANOparticle synthesis BY NANOsecond repetitively pulsed plasma discharges at atmospheric pressure



INSPIRATION

The portable, on-demand, and point-of-use synthesis of nanoparticles (NP) can improve the feasibility of portable applications requiring such materials. Currently, many synthesis techniques require fixed-site, complex facilities, hence prohibiting on-demand NP production at a remote location. As a result, mobile devices must store and deliver pre-made NP, which adds cost and complexity. Stored NP can agglomerate and sediment, becoming unstable. Delivery to the point of use may require transformation of the NP storage medium, which could be energetically expensive and slow the responsiveness of the device. Furthermore, certain applications may require a variety of NP properties to adapt to changing usage conditions, which would complexify on-board storage/delivery systems. There exists thus a growing need to develop a new NP synthesis paradigm that can achieve fast and efficient synthesis using a simple and compact platform capable of exerting fine control over NP properties. Plasmas can meet these challenges by producing physico-chemical conditions that are difficult to achieve otherwise. However, existing NP synthesis techniques using plasmas suffer from certain weaknesses.

INnovaTION

NANObyNANO aims to develop a fundamental and detailed understanding of NP synthesis by plasma. Our experimental approach will feature state-of-the-art in-situ laser diagnostics of spatiotemporal NP growth, using coherent anti-Stokes Raman spectroscopy and coherent Rayleigh-Brillouin scattering, as well as optical diagnostics of plasma properties. With the detailed spatiotemporal input from these diagnostics, we will develop a theoretical model of nanoparticle formation in NRP discharges.

Impact

Ultimately, the fundamental understanding developed by NANObyNANO will enable the use of NRP discharges for the production of rationally designed NP with well-defined properties (morphology, composition) in a simple, highly energy-efficient way. The results of NANObyNANO can eventually lead to a future mobile platform for the on-demand NP synthesis directly at the point of use, eliminating the need for on-board storage/delivery systems. The process can be single-step, highly efficient in its use of energy and precursor material, and enable on-demand adjustment of NP properties.

Partners
Ecole Polytechnique (FR)

Financial Support
Fonds National de la Recherche Luxembourg , ANR

Contact
5, avenue des Hauts-Fourneaux
L-4362 Esch-sur-Alzette
phone: +352 275 888 - 1 | LIST.lu

Alexandros GERAKIS (alexandros.gerakis@list.lu)

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST