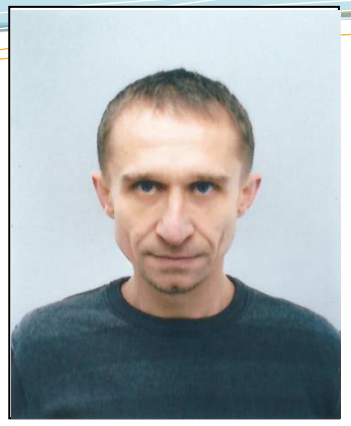
東海大学創造科学技術研究機構
TOKAI UNIVERSITY INSTITUTE OF INNOVATIVE SCIENCE AND TECHNOLOGY

Materials Science of Nanostructures

Kulinich LAB
クリニッチ研究室



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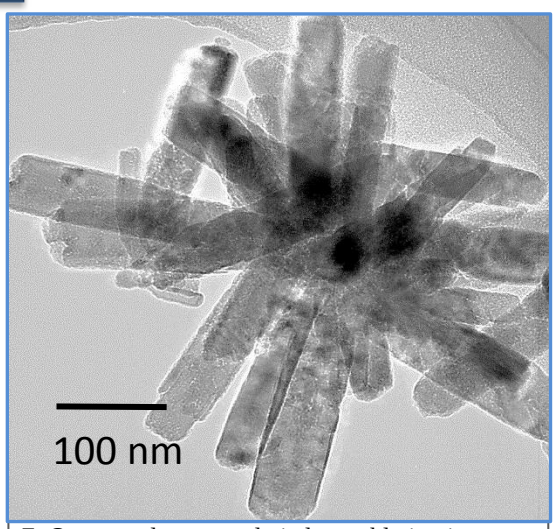
Nanostructures: design, preparation, applications

Keywords: materials, characterization, nanostructures, laser ablation, devices

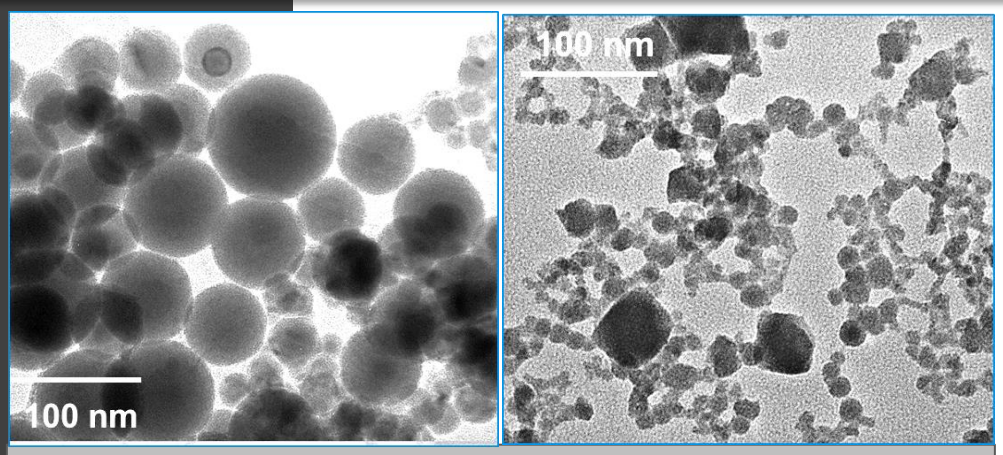
Background and Motivation

The special structure of nanomaterials gives rise to their amazing properties, from magnetic to mechanical, from electric to optical, among others. As such, nanostructures are very attractive candidates for photocatalysis, sensing and photonic devices, as they have a combination of unique electronic and optical properties. Importantly, the shape and size of nano-objects define their physical properties, and hence the ability to manipulate the morphology and composition at the nanoscale provides immense opportunities for creating new materials with superior performance for new products and devices. Therefore, the present research aims at three main goals: (i) preparation of novel nanomaterials with various morphologies and chemistries (via laser ablation in liquid and wet-chemistry approaches); (ii) study of their formation and properties; (iii) design and fabrication of devices (such as, e.g., chemiresistive gas and photonic sensors) or using the prepared nanostructures as materials for applications in photovoltaics, photocatalysis and so on; and (iv) development of biomedical materials that use laser-generated nanomaterials.



ZnO nanorods prepared via laser ablation in water.

Originality



SnO_x nanostructures laser-ablated in water under different conditions.

The originality and innovative nature of the project are based on: (i) exploiting the ability of laser beam to produce nanomaterials with unique properties; (ii) systematic approach to production of nanostructures with different morphologies and chemistries and testing them in sensing and photonic devices; (iii) combining surface-science, chemical and optical analyses (multidisciplinary approach) to nanostructures as potential building blocks for devices; (iv) developing devices that employ chemical, optical and even medicinal properties of nanostructures.

Impact and Perspective

The growing industrial demand for cost-efficient, flexible and reliable technologies for the fabrication of components and devices at small physical scales requires new breakthrough approaches to the preparation, morphology control, and processing of nanomaterials. The current project deals with new approaches to grow diverse novel nanomaterials with various morphologies, sizes and chemistries, their characterization and surface modification, with the final goal to fabricate nanomaterial-based devices, such as, e.g., chemiresistive or photonic sensors that use nanostructures to detect gases, saturable absorbers for lasers, photovoltaic cells, or to use them as photocatalysts, nanocontainers in biomedical materials, and so on.

■ For more information:

www.u-tokai.ac.jp/tuiist/tt/announcement_kulinich.html

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