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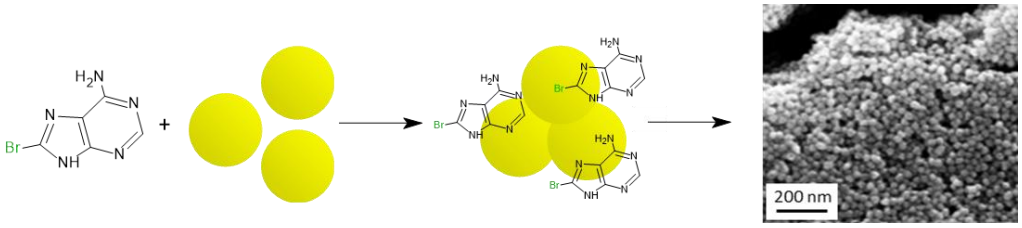
Influence of nanoparticle size on plasmon-induced reactions

Description



The research work of Christina Beresowski from the Colloid Chemistry group headed by Prof. Dr. Ilko Bald deals with plasmon-induced reactions caused by the excitation of nanoparticles and the associated generation of so-called "hot electrons". In particular, the size effect of the plasmonic nanoparticles on the reaction kinetics is investigated. For this purpose, the molecules to be studied must adsorb on the surface of the nanoparticles. In the next step, the functionalized nanoparticles are dropped onto a silicon wafer, where they aggregate after subsequent drying. Surface-enhanced Raman spectroscopy (SERS) is used to induce and simultaneously follow the reaction. So far, the focus has been on the dehalogenation of 8-bromoadenine, since bromine derivatives of purine nucleobases show a pronounced susceptibility to free and plasmonically generated low-energy electrons, making them suitable as model systems. In order to compare the effect of size on the reaction rate, dehalogenation was determined via decay curves. An increase in reaction rate was found with increasing nanoparticle size. This result can be explained by the increase in absorption cross section. However, it was also found that an influence can be attributed to the disordered aggregated structures. To study only the size effect, work is currently underway to develop templates using DNA origami on which the influence of size alone can be studied.

Spectrum of Methods

- Scanning force electron microscope
- Surface-enhanced Raman spectroscopy (SERS)

Literature

- Anushree Dutta, Robin Schürmann, Sergio Kogikoski Jr., Niclas S. Mueller, Stephanie Reich, Ilko Bald. Kinetics and Mechanism of Plasmon-Driven Dehalogenation Reaction of Brominated Purine Nucleobases on Ag and Au. *ACS Catal.* 2021, **11** (13), 8370−8381.
- Seokheon Kim, Sungwoon Lee, Sangwonn Yoon. Effect of Nanoparticle Size on Plasmon-Driven Reaction Efficiency. *ACS Appl. Mater. Interfaces* 2022. **14** (3), 4163-4169.

Applications

- Plasmon chemistry
- Photocatalysis
- Sensor technology
- Filter materials
- Analysis

Keywords

- Nanoparticles
- SERS
- DNA origami
- Reaction mechanism

Interest in cooperation

- Research-based collaboration
- Contract research
- Industry-sponsored research

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