JOHANNES KEPLER
UNIVERSITÄT LINZ

Institut für Angewandte Physik
Univ. Prof. Dr. Thomas A. Klar

Im Rahmen des Projektseminars

Besprechung neuerer Arbeiten aus Angewandter Physik
LVA Nr. 374.008

spricht

Herr Gustav Gürtler

Johannes Kepler Universität, Linz

über

Plasmon-Driven Photocatalysis

Photocatalysis utilizes energy provided by electromagnetic radiation to increase the rate of chemical reactions. Plasmonic nanostructures seem to be an ideal candidate to be used as light-activated catalysts due to their exceptional interaction with light. They harness energy provided by electromagnetic radiation over a broad and tunable spectral range. The process enabling them to absorb photons is the excitation of localized surface plasmons. This describes collective oscillations of quasi-free electrons in the nanoparticle, but, in contrast to surface plasmon polaritons excited on bulk surfaces, they oscillate over the whole volume of the nanostructure. Optically excited plasmonic nanoparticles are capable to transfer their energy to molecules on their surface and therefore influence the reaction rate of a possible chemical reaction [1,2,3].

A desirable application of plasmon-induced photocatalysis is the conversion of CO_2 molecules into transportable and storable liquid fuels using visible light, which benefits the reduction of the drastically increased CO_2 level in the atmosphere. Furthermore, the sun provides a free source of photons capable of driving these chemical reactions, providing a great possibility for environmentally friendly CO_2 recycling, often referred as artificial photosynthesis [4].

This presentation gives an overview of plasmon induced photocatalysis. Furthermore, the possibilities and challenges of sunlight-driven recycling of CO_2 molecules is discussed.

[1] Camargo P.H.C, Cortés E.; Plasmonic Catalysis: From Fundamentals to Applications, John Wiley & Sons, 2021

[2] Srivastava A A. K., Rishikesh A Yadev; Rai A.V.N, Ganguly A Tapas, Deb A S. K.; Surface plasmon resonance in gold nanoparticles; J AIP Conference Proceedings, 2012, p. 305-306, DOI: 10.1063/1.4710001

[3] K Andrew J. Wilson and Prashant K. Jain; Accounts of Chemical Research 2020 53 (9), 1773-1781; DOI: 10.1021/acs.accounts.0c00378

[4] Yu, S.; Wilson, A. J.; Kumari, G.; Zhang, X.; Jain, P. K. Opportunities and Challenges of Solar-Energy-Driven Carbon Dioxide to Fuel Conversion with Plasmonic Catalysts. ACS Energy Lett. 2017, 2 (9), 2058– 2070, DOI: 10.1021/acsenergylett.7b00640

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