

Surface plasmon resonance photovoltaic effect





Overview

What is plasmon resonance in photovoltaic applications?

The resonances of noble metals are mostly in the visible or infrared region of the electromagnetic spectrum, which is the range of interest for photovoltaic applications. The surface plasmon resonance is affected by the size, shape and the dielectric properties of the surrounding medium.

What affects surface plasmon resonance?

The surface plasmon resonance is affected by the size, shape and the dielectric properties of the surrounding medium. Silver and gold have dominated experimental research in this area although other metals also support surface plasmons.

How plasmon resonance can be tuned?

By manipulating the geometry of the metallic structures, the surface plasmon resonance or plasmon propagating properties can be tuned depending on the applications. The resonances of noble metals are mostly in the visible or infrared region of the electromagnetic spectrum, which is the range of interest for photovoltaic applications.

Can plasmonics improve light absorption in thin solar cells?

There is a clear need for technologies that lead to better light absorption in thin solar cells in order to allow higher efficiencies and hence lower overall costs of electricity production. Plasmonics has the potential to revolutionise the photovoltaic industry and deliver high efficiency, low cost solar cells.

What is surface plasmon resonance (SPR)?

The field of plasmonics relies on the collective oscillations of electrons excited by electromagnetic radiation at a metal-dielectric interface, which gives rise to the term surface plasmon resonance (SPR). SPR enables large wavevectors and thus field confinement (Fig. 1d) 73, 74, 75.



Will plasmonics benefit photovoltaic research?

There is no doubt that photovoltaic research will benefit immensely from plasmonics, enabling use of low quality low cost materials and delivering cells with high performance and low cost. The ARC Photovoltaic Centre of Excellence is funded under the Australian Research Council's Centre of Excellence Scheme.



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Recent review of surface plasmons and plasmonic hot electron effects ...

Plasmonic resonators are widely used for the manipulation of light on subwavelength scales through the near-field electromagnetic wave produced by the collective oscillation of free electrons within metallic systems, well known as the surface plasmon (SP). The non-radiative decay of the surface plasmon can excite a plasmonic hot electron. This review ...

Synergistic Effects of Localized Surface Plasmon Resonance, Surface

This work explores the utilization of plasmonic resonance (PR) in silver nanowires to enhance the performance of organic solar cells. We investigate the simultaneous effect of localized surface plasmon resonance (LSPR), surface plasmon polariton (SPP),



Efficiency enhancement of organic solar cell using surface plasmon

Ag nanoparticles (NPs) of varied concentrations are implemented in the hole transport layer (PEDOT:PSS) of organic solar cells to enhance the photoconversion efficiency through near field effects, one of the basis of surface plasmonic resonances. The Ag NPs were synthesized through a wet chemistry reduction process by varying the reaction times to yield ...



Plasmonic-perovskite solar cells, light emitters, and sensors

There are two types of plasmonic modes,



propagating surface plasmon polaritons (SPPs) (Fig. 1e) and localized surface plasmon resonances (LSPRs) (Fig. 1f), and ...



Surface Plasmonic Effects of Metallic Nanoparticles on the ...

We have systematically explored how plasmonic effects influence the characteristics of polymer photovoltaic devices (OPVs) incorporating a blend of poly (3 ...

Surface plasmon resonance

Surface plasmon resonance (SPR) spectroscopy is a technique to detect biomolecular binding interactions. In Here, the authors present a plasmonic sensor integrated in a photovoltaic cell



Surface plasmon resonance technology: Recent advances, ...

The phenomenon of Surface Plasmon Resonance (SPR) gives rise to a spectroscopic method that allows for real-time monitoring of the interactions between a free ...



Plasmon-enhanced light-matter interactions and applications

Over the past decades, surface plasmons (SPs) have attracted much attention due to its subwavelength spatial profile of modal field that can be harnessed to dramatically ...



Plasmonic Electrochemistry (Surface Plasmon Effect)

Yu K, Sakai N, Tatsuma T (2008) Plasmon resonance-based solid-state photovoltaic devices. *Electrochemistry* 76:161 CAS Google Scholar Takahashi Y, Tatsuma T (2011) Solid state photovoltaic cells based on localized surface plasmon-induced

Surface Plasmon

Diverse bio-sensing and therapeutic applications of plasmon enhanced nanostructures Shirsendu Mitra, Mitali Basak, in *Materials Today*, 2022 Fundamentals of plasmon and SERS Technically, surface plasmon is the natural electronic oscillation of the outermost conduction band electrons of metals at the interface of metal and dielectric. . Amplification of natural oscillation of this ...



Surface plasmonic effects on organic solar cells

Most high-performance organic photovoltaic (OPV) devices reported in the literature have been fabricated using the bulk heterojunction (BHJ) concept. Typically, the optimum thickness of the active layer for an OPV device is around 100 nm, or possibly less; such a thin layer can lead to low absorptio ...



Research Progress of Plasmonic Nanostructure-Enhanced ...

Therefore, to enhance light absorption and PCE of OPVs with a thicker active layer, the surface plasmon resonance effect might be utilized by introducing metallic ...



Localized surface plasmon resonances dominated giant lateral

We report substantially enlarged lateral photovoltaic effect (LPE) in the ZnO/Ag/Si nanostructures. The maximum LPE sensitivity (55.05 mv/mm) obtained in this ...

Plasmon-induced hot-hole generation and extraction at nano

Localized surface plasmon resonance excitation presents tremendous opportunities for light-harvesting in the field of photocatalysis. Notably, the use of plasmon-generated hot carriers to drive



Plasmonic-perovskite solar cells, light emitters, and sensors

e Surface plasmon polariton (SPP) and (f) localized surface plasmon resonance modes (LSPRs). Full size image The most prominent application of halide perovskites is as light-absorbing materials in



Surface Plasmon Resonance Effect in Inverted Perovskite Solar ...

The introduction of localized surface plasmons in CH₃NH₃PbI_{2.85}Br_{0.15}-based photovoltaic system, which occur in response to electromagnetic radiation, has shown ...



Localized surface plasmon resonance: Nanostructures, bioassays ...

Localized surface plasmon resonance (LSPR) is an optical phenomena generated by light when it interacts with conductive nanoparticles (NPs) that are smaller than the incident wavelength. As in surface plasmon resonance, the electric field of incident light can be



Lateral photovoltaic effect observed in nano Au film covered two

Periodic nanostructure, especially for nano-spheres' structure, is one of the key issues in the current research, due to its anomalous transmission of light and obvious surface plasmon resonance. In this work, a type of anisotropic lateral photovoltaic effect is observed in the Au films covered two-dimensional colloidal crystals (CCs). This finding of lateral photovoltaic ...



Surface Plasmon Resonance Effect in Inverted Perovskite Solar ...

This work reports on incorporation of spectrally tuned gold/silica (Au/SiO₂) core/shell nanospheres and nanorods into the inverted perovskite solar cells (PVSC). The band gap of hybrid lead halide iodide (CH₃NH₃PbI₃) can be gradually increased by replacing iodide with increasing amounts of bromide, which can not



only offer an appreciate solar radiation ...



Surface plasmon resonance

If the surface is patterned with different biopolymers, using adequate optics and imaging sensors (i.e. a camera), the technique can be extended to surface plasmon resonance imaging (SPRI). This method provides a high contrast of the images based on the adsorbed amount of molecules, somewhat similar to Brewster angle microscopy (this latter is most commonly used together ...



Surface plasmon resonance of silver nano-dendrites improved ...

Surface plasmon resonance (SPR) or so-called plamonics behaviour is well-known for its tunability along the light absorption spectrum. Additionally, there are number of parameters alteration could be tuned to tailor the materials' characteristics towards

Tunable Surface Plasmon Resonance in Metal-Dielectric ...

A model system of metal nanocomposite structures separated by dielectric layers has been developed to reveal the impact of the dielectric matching layer on surface plasmon resonance (SPR) in multilayer structures. The research results indicate that SPR is highly sensitive to the dielectric constant and interface thickness of the dielectric layer. The ...





Enhancing photonic spin Hall effect via long-range surface ...

We presented the significant enhancement of the photonic spin Hall effect by taking advantage of long-range surface plasmon resonance (LRSPR). The influence of the thicknesses of metal ...



Greatly enhanced photocurrent density in bismuth ferrite films by

Photocatalytic hydrogen production from formic acid (FA) is a daunting challenge, yet an essential task for the development of hydrogen energy this study, a p-NiO/n-TiO₂ heterojunction incorporating 7-nm metallic Ni was fabricated, which demonstrated a remarkable localized surface plasmon resonance (LSPR) effect. . Notably, 5 wt% Ni/TiO₂ exhibited 1271 ...



Surface plasmon resonance technology: Recent advances, ...

For this reason, the Surface Plasmon Resonance (SPR) technology emerged as very successful particularly in the last ten years, Temperature effects on the resolution of surface-plasmon-resonance-based sensor Plasmonics, 14 (2019), pp. 763-768, 10.1007

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