Abstract title

Optical Characterization of Plasmon-Polaritons at a Silver Silicon Interface for Solar Cell Efficiency Improvement

Author

Englisch, Andreas, Saarland University, Saarbrücken, Germany(P)

Co-author(s)

Griesing, S.G. , Saarland University, Saarbrücken, Germany

Schmitt, U.S. , Saarland University, Saarbrücken, Germany

Hartmann, U.H. , Saarland University, Saarbrücken, Germany

Topic

Electronic and optical properties and surface plasmons including plasmonic devices

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Abstract text
Thin film solar cells with photoactive layer based on a-Si exhibit a low absorption efficiency especially in the wavelength regime larger than 900 nm. Plasmonic structures in front of the solar cell are known to improve the cell efficiency due to the mechanism of intensified forward scattering and near-field enhancement effects of localized plasmons.
In our approach tangentially propagating plasmon-polariton modes on a silver silicon interface at the back reflector are used for this purpose. The basic idea is to extend the optical path by these excitations. The direct detection of the plasmon-polariton mode at the uncorrugated silicon-silver interface is difficult because the wave vector is strongly increased due to the high refractive index of silicon. Thus, the plasmons cannot couple with light. In order to characterize them nevertheless, areas with and without silicon coating on a silver surface were produced by lithography. A two dimensional plasmon beam is excited in areas without coating and is deviated if it passes the structural border. The in-plane distribution of the plasmon-polariton intensity is measured by SNOM and leakage microscopy.
The transmission and reflection behavior as well as the scattered light and the intrinsic absorption at the border will be discussed on the base of experimental and theoretical results. A concept to increase the coupling efficiency of incoming light and to minimize scattering effects and intrinsic losses will be introduced.

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