Highly Efficient Ultrathin Plasmonic Insulator-Metal-Insulator-Metal Solar Cell

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Abstract: Nano-porous ultrathin plasmonic insulator-metal-insulator-metal (IMIM) solar cell with high power conversion efficiency up to 7% in broad wavelength range from 300 to 750 nm was theoretically studied. The proposed IMIM design allows to choose various bottom insulators with desired barrier height of metal-insulator interface due to independence of the total absorbance on the bottom insulator. IMIM structure shows 73.8% difference in the average absorbance between the

top and bottom metal layers with 1-nm bottom insulator. Moreover, the incident light decreases the absorbance negligibly up to 35 degrees for both TE and TM modes and by 17.5% at 70 degrees. Furthermore, the absorption between TE and TM modes differs by less than 5%, which indicates the structure as polarization independent. Our results indicate IMIM design benefit in plasmonic solar cells demanding low thickness, flexibility, low-cost, and polarization independence. Moreover, this structure can be implemented for integrated optical circuits as well as for solar thermoelectric generator.

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