Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Broadband Tamm plasmon-enhanced planar hot-electron photodetector

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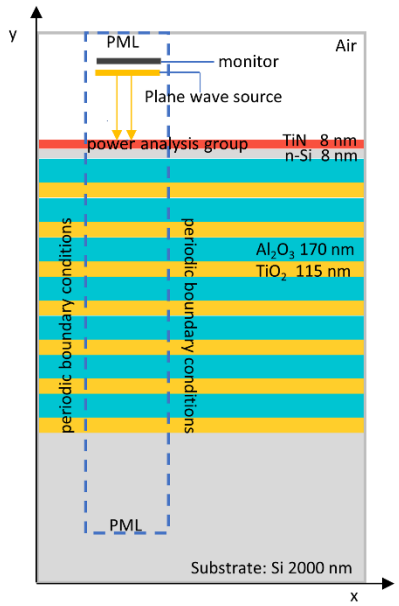

Figure S1 Simulation framework of the HEPD: x-y cross-sectional view of the HEPD. The dashed line in the figure represents the simulation area of FDTD. The simulation is two-dimensional. The structure is surrounded by air, and the background has a refractive index of 1, and a temperature of 300 K. The simulation time is set to 5000 fs; the mesh accuracy is 5, and the mesh size is 0.5 nm*0.5 nm. To ensure the results' accuracy, we optimized the simulation settings, such as mesh accuracy and boundary conditions, until the simulation results are convergent. In the FDTD simulation unit cell, boundaries in the y-axis direction are set as a perfect matching layer (PML); periodic boundaries are used in the x-axis direction. The incident plane wave illuminates the structure vertically from the top side of the structure. A power analysis group is used to collect the absorption of the metal layer. A monitor is placed between the PML layer and the source layer.

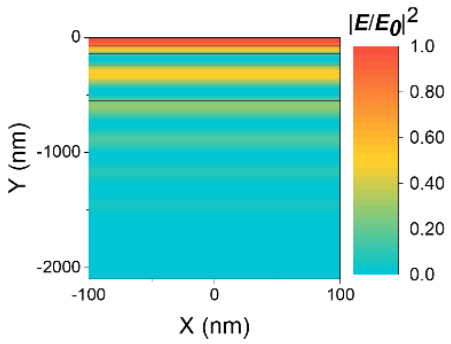

Figure S2 The electric field profile of the TiN, n-Si, and all DBRs at the wavelength of 1150 nm.

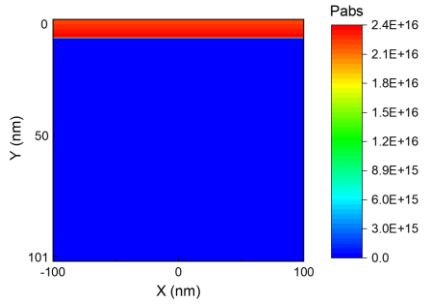

Figure S3 Absorption distribution map of the proposed structure at the wavelength of 1150 nm.

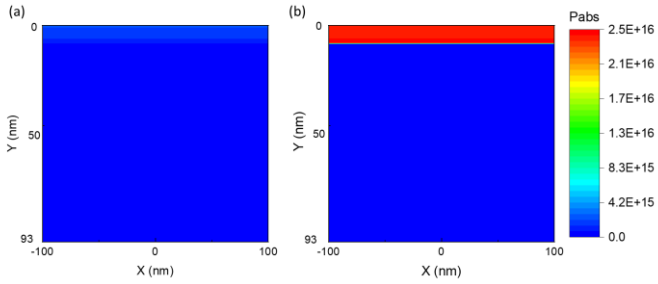

Figure S4 Absorption distribution map of (a)DBR-HL+TiN and (b)DBR-LH+TiN at 1090 nm，respectively. The position of y=0 is the upper surface of the TiN layer.

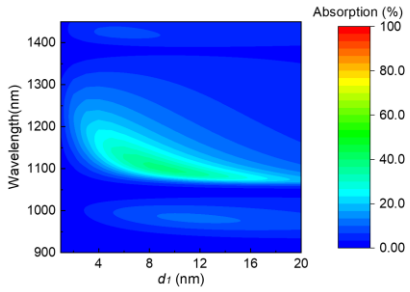

Figure S5 Absorption spectra of the photodetector composed of DBR+Si+Au with different d_1.

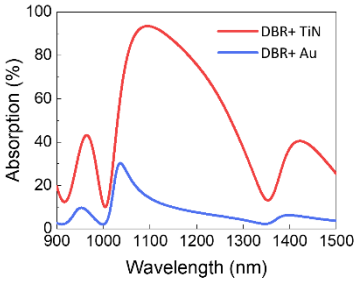

Figure S6 Absorption spectra of the top metal layer (TiN or Au) in the proposed structure.

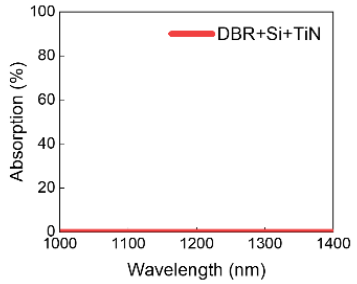

Figure S7 Absorption spectrum of the semiconductor layer in the structure composed of DBR+Si+TiN.

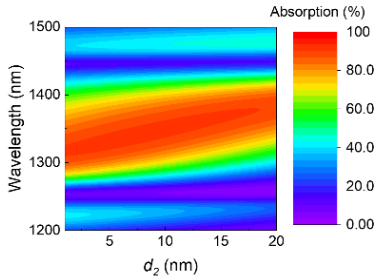

Figure S8 Absorption spectra of the photodetector composed of DBR+Si+TiN with different d_2.

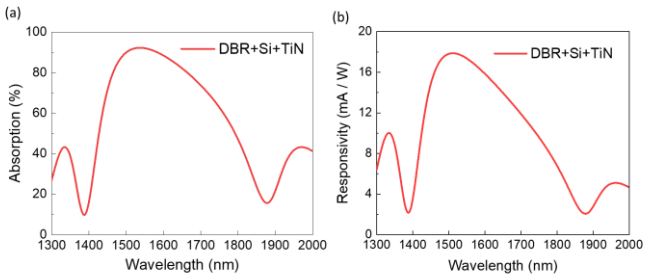

Figure S9 (a) Absorption spectrum and (b) responsivity spectrum of the photodetector composed of DBR+Si+TiN when λ_{DBR} is set to 1600 nm.

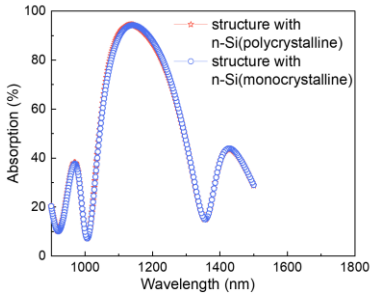

Figure S10 Absorption spectra of the structure with polycrystalline n-Si and monocrystalline n-Si, respectively. The optical constant of monocrystalline n-Si is taken from Palik,[1] and the optical constant of polycrystalline n-Si is taken from Scheid.[2]

References

1. E. D. Palik, *Handbook of Optical Constants of Solids*, 1998.
2. Y. Laghla and E. Scheid, *Thin Solid Films*, 1997, **306**, 67-73.