CLAIMS

What is claimed is:

1. A photodetector, comprising:

a semiconductor having a region that is etched to form a plurality of micro to nanostructures;

an ohmic contact electrode forming an ohmic contact with a surface of the semiconductor;

a metal electrode having a metal film and an electrode, the metal film covering a surface of the micro-nanostructures and forming a Schottky contact with the surface of the micro to nanostructures, the electrode connecting the metal film;

an incident light;

wherein each of the plurality of micro to nanostructures comprises multiple linear cavity lengths, and a wavelength of the incident light corresponds to one of the linear cavity lengths to induce a localized surface plasmon resonance (LSPR);

wherein carriers in the metal electrode are excited by the incident light to form electron hole pairs or hot carriers to cross a Schottky barrier between a junction of the metal electrode and the semiconductor and thus form a photocurrent.

2. The photodetector as recited in claim 1, wherein the plurality of micro to nanostructures are inverted pyramid structures or upright pyramid structures.

3. The photodetector as recited in claim 1, wherein the incident light enters from the surface of the semiconductor.

4. The photodetector as recited in claim 1, wherein photons with energy smaller than the Schottky barrier and the band gap of semiconductor both can be detected.

5. The photodetector as recited in claim 2, wherein the incident light with a wavelength range of 500 nm to 4000 nm can induce localized surface plasmon resonance in the inverted pyramidal structures.

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6. The photodetector as recited in claim 2, wherein the incident light with a wavelength range of 1000 nm to 10000 nm can induce localized surface plasmon resonance in the upright pyramidal structures.

7. The photodetector as recited in claim 2, wherein the period of inverted pyramidal structures is four times the wavelength of the incident light.

8. The photodetector as recited in claim 1, wherein the localized surface plasmon resonance is polarization-insensitive.

9. The photodetector as recited in claim 2, wherein the absorption spectrum of the photodetector has an absorption ratio more than 80% in the wavelength range between 450 nm and 2700 nm.