CLAIMS

1. A traveling wave electrode modulator comprising: a silicon base, an optical waveguide disposed in the silicon base, a doped transitional area disposed on both sides of the optical waveguide and connected to the optical waveguide, and a traveling wave electrode structure electrically connected to the transitional area; wherein: the traveling wave electrode structure comprises at least one layer of a continuous electrode continuously extending along a direction of extension of the optical waveguide, at least one layer of a periodic electrode periodically changing along the direction of extension of the optical waveguide, and a conductive structure; and the continuous electrode is electrically connected to the periodic electrode via the conductive structure, and the traveling wave electrode structure is electrically connected to the transitional area via the conductive structure;

wherein the traveling wave electrode structure comprises two or more layers of periodic electrodes, and/or two or more layers of continuous electrodes.

2. The traveling wave electrode modulator of claim 1, wherein the periodic electrode and the continuous electrode are disposed in an alternating manner, or the two or more layers of the periodic electrodes are disposed in an adjacent manner.

3. The traveling wave electrode modulator of claim 1, wherein structural parameters of the periodic electrodes at different layers are identical or different; and the structural parameters comprise a period and a duty cycle.

4. The traveling wave electrode modulator of claim 1, wherein: the continuous electrode and the periodic electrode each comprise a signal electrode and a ground electrode; and there is an electrode spacing distance between the signal electrode and the ground electrode at a same layer, and electrode spacing distances at different layers are identical or different.

5. The traveling wave electrode modulator of claim 1, wherein the conductive structure comprises a conductive via.

6. The traveling wave electrode modulator of claim 1, wherein: the silicon base comprises a silicon substrate, an insulation layer, and an optical waveguide layer which are layered sequentially, the optical waveguide and the transitional area are located in the optical waveguide layer; and the traveling wave electrode structure is disposed above the optical waveguide layer.

7. The traveling wave electrode modulator of claim 6, wherein: a groove is provided at a surface of the silicon substrate near the insulation layer, the groove

being located below the optical waveguide and disposed along the optical waveguide;

or, a channel penetrating through a top surface and a bottom surface of the silicon substrate is disposed in an area of the silicon substrate below the optical waveguide.

8. The traveling wave electrode modulator of claim 6, wherein a cover layer is disposed on the optical waveguide layer, and the traveling wave electrode structure is disposed in the cover layer.

9. A photonic integrated chip, comprising the traveling wave electrode modulator of any of claims 1 through 8.