CLAIMS

1.An optical waveguide, comprising:

an optical waveguide layer, and a modulation layer located on the optical waveguide layer, wherein a first isolation layer is provided between the optical waveguide layer and the modulation layer, and the modulation layer is covered with a first protective layer; and,

a second isolation layer surrounding the first isolation layer and the modulation layer, wherein the second isolation layer has an inverted L-shaped cross-section; and,

a second protective layer surrounding the first protective layer, the second isolation layer, and the optical waveguide layer;

wherein the modulation layer is enclosed in a sealed cavity together defined by the first protective layer, the first isolation layer and the second isolation layer; and the modulation layer is or comprises a phase-change material layer.

2.The optical waveguide according to claim 1, wherein the first isolation layer and the second isolation layer together define a second groove having an opening facing the first protective layer, and a height from a groove bottom of the second groove to a top opening thereof is greater than or equal to a thickness of the modulation layer.

3.The optical waveguide according to claim 2, wherein the second groove is formed by etching, by a regional etching method, the second isolation layer that is pre-coated on the optical waveguide layer and has a T-shaped or concave-shaped cross-section and the second protective layer coated on the optical waveguide layer and the second isolation layer.

4.The optical waveguide according to any one of claims 1-3, wherein the phase-change material layer is formed by sputtering a phase-change material onto the first isolation layer; and/or the first protective layer is deposited on the phase-change material layer by a physical vapor deposition process or a chemical vapor deposition process.

5.The optical waveguide according to any one of claims 1-3, wherein an upper surface of the first protective layer is flush with an upper surface of the second protective layer.

6.The optical waveguide according to any one of claims 1-3, wherein a thickness of the first isolation layer is 1 nm-100 nm; and/or a length of the first isolation layer extending along a length direction of the optical waveguide is 1 μm-10 μm; and/or a thickness of the first protective layer is 0.1 μm-3 μm; and/or a thickness of the modulation layer is 1 nm-1 μm; and/or a length of the modulation layer extending along the length direction of the optical waveguide is 1 μm-10 μm.

7.The optical waveguide according to any one of claims 1-3, wherein

the phase-change material layer is made of a superlattice material; or

the phase-change material layer is formed of a chalcogenide compound containing antimony or selenium; or

the phase-change material layer comprises a chalcogenide compound, wherein the chalcogenide compound includes at least one of Sb_2Se_3, SbSe, Sb_2S_3, SbS, and $Ge_2Sb_2Se_4Te$; or

the phase-change material of the phase-change material layer comprises a compound, an alloy, or a mixture thereof, wherein the compound or the alloy contains one or more of germanium, antimony, selenium, and vanadium oxide; wherein the compound includes at least one of NbOx, GeTe, GeSb, GaSb, AgInSbTe, InSb, InSbTe, InSe, SbTe, TeGeSbS, AgSbSe, SbSe, GeSbMnSn, AgSbTe, AuSbTe and AlSb.

8.The optical waveguide according to any one of claims 1-3, wherein the optical waveguide comprises a metal interconnect layer embedded in the second protective layer; and/or the optical waveguide layer has a rectangular or convex-shaped cross-section.

9.The optical waveguide according to any one of claims 1-3, wherein the first protective layer is made of one or more of SiO_2, Al_2O_3, and ITO; and/or the second protective layer is made of one or more of SiO_2, Al_2O_3, and ITO; and/or the first isolation layer is made of one or both of Si_3N_4, and TiN; and/or the second isolation layer is made of one or both of Si_3N_4 and TiN.

10.A method for manufacturing the optical waveguide according to any one of claims 1-9, comprising the steps of:

S1021, integrating an optical waveguide layer on a substrate to form an optical waveguide platform;

S1023, forming, on an outer surface of the optical waveguide layer exposed above the substrate, a second stop layer having a third thickness and a second oxide layer having a second thickness by physical vapor deposition or chemical vapor deposition, wherein the second stop layer is located above the optical waveguide layer and has a T-shaped or concave-shaped cross-section, and a width of a vertical portion of the T-shaped second stop layer is greater than a width of the optical waveguide layer, or a width of the concave-shaped second stop layer is greater than the width of the optical waveguide layer;

S1025, performing a windowing process on the second stop layer and the second oxide layer by regional etching, so that the second stop layer forms, on the optical waveguide layer, a first isolation layer having a fourth thickness and a second isolation layer surrounding the first isolation layer and having an inverted L-shaped cross-section, wherein the fourth thickness is less than the third thickness;

S1027, using a first thin-film deposition process to deposit a phase-change material onto a surface of the first isolation layer by physical vapor deposition, so as to form a phase-change material

layer with a predetermined thickness in a window defined by the first isolation layer and the second isolation layer surrounding the first isolation layer, the predetermined thickness being less than or equal to a difference between the third thickness and the fourth thickness;

S1029, using a second thin-film deposition process to deposit an oxide layer of the same material as in step S1023 onto the phase-change material layer to cover the phase-change material layer, so as to obtain a first protective layer having a sixth thickness.