Method For Producing A Monocrystalline Layer Of An LNO Material And Substrate For Epitaxial Growth Of A Monocrystalline Layer Of An LNO Material

FIELD OF THE INVENTION

The present invention relates to a process for producing a monocrystalline layer of lithium niobate (LNO) material and a substrate for the epitaxial growth of such a monocrystalline layer of LNO material.

PRIOR ART

Certain materials are not currently available as a monocrystalline substrate in the form of a large-diameter wafer. Moreover, certain materials may be available in large diameter but not with certain characteristics or specifications in terms of quality, in particular with regard to the density of defects or the required electrical or optical properties.

SUMMARY OF THE INVENTION

Embodiments of the present invention aim to overcome these limitations of the prior art by providing a process for producing a monocrystalline layer of LNO material and a substrate for the epitaxial growth of such a monocrystalline layer of LNO material. In this way it is possible to address the problem of size of the monocrystalline substrates of LNO material currently available.

An aspect of the invention provides a process for producing a monocrystalline layer of lithium niobate (LNO) material, the process comprising a transfer of a monocrystalline seed layer of yttria stabilized zirconia (YSZ) material to a carrier substrate of silicon material, and followed by an epitaxial growth of the monocrystalline layer of LNO material on the monocrystalline seed layer of YSZ material, wherein the carrier substrate of silicon material comprises a detachable interface configured to withstand mechanical and/or thermal stresses during the epitaxial growth and to be detached by means of a laser debonding technique and/or chemical attack and/or by means of mechanical stress after the epitaxial growth.

In advantageous embodiments, the monocrystalline seed layer has a thickness of less than 10 µm, preferably less than 2 µm, and more preferably less than 0.2 µm.

CLAIMS

1. A process for producing a monocrystalline layer of lithium niobate (LNO) material, the process comprising:

a transfer of a monocrystalline seed layer of yttria stabilized zirconia (YSZ) material to a carrier substrate of silicon material; and

followed by an epitaxial growth of the monocrystalline layer of LNO material on the monocrystalline seed layer of YSZ material,

wherein the carrier substrate of silicon material comprises a detachable interface configured to withstand mechanical and/or thermal stresses during the epitaxial growth and to be detached by means of a laser debonding technique and/or chemical attack and/or by means of mechanical stress after the epitaxial growth.

2. The process as claimed in claim 1, wherein the monocrystalline seed layer of YSZ material has a thickness of less than 10 µm, preferably less than 2 µm, and more preferably less than 0.2 µm.

3. The process as claimed in claim 1 or 2, wherein the transfer of the monocrystalline seed layer of YSZ material to the carrier substrate of silicon material comprises a step of joining a monocrystalline substrate of YSZ material to the carrier substrate followed by a step of thinning said monocrystalline substrate of YSZ material.

4. The process as claimed in claim 3, wherein the thinning step comprises the formation of a weakened zone delimiting a portion of the monocrystalline substrate of YSZ material intended to be transferred to the carrier substrate of silicon material.

5. The process as claimed in claim 4, wherein the formation of the weakened zone is obtained by implanting atomic and/or ionic species.

6. The process as claimed in claim 4 or 5, wherein the thinning step comprises detaching at the weakened zone so as to transfer said portion of the monocrystalline substrate of YSZ material to the carrier substrate of silicon material, in particular the detaching comprises the application of a thermal and/or mechanical stress.

7. The process as claimed in any one of claims 3 to 6, wherein the joining step is a molecular adhesion step.

8. The process as claimed in any one of the preceding claims, wherein the monocrystalline seed layer of YSZ material is in the form of a plurality of tiles each transferred to the carrier substrate of silicon material.