function layer that has low refractive index comparing to the waveguide layer in order for optical light confinement.

In a next step of the process, a waveguide 208 is deposited over the BOX layer. This layer has a thickness of between a few tens of nm to a few µm and comprises for example silicon, silicon nitride (SiN); silicon oxynitride (SiON), Polycrystalline Si or amorphous Si. In a photonics chip, for example a waveguide is deposited above the BOX layer. Different devices may be fabricated at this point as is required for the proposed chip. For different types of chip, other devices may be fabricated. Any appropriate device could be added depending on the application and function of the chip.

In a next step of the process, an upper cladding layer 210 is deposited over the device depending on the necessity. This layer has a thickness of a few µm and comprises for example and oxide layer.

In a next process step, deep trenches 212 are applied over the wafer. Two are located on either side of the waveguide in the example shown. The trenches are formed by any appropriate process and may include for example Reactive Ion Etching (RIE) or Inductively Coupled Plasma Etching (ICP). The trenches are formed to be only as deep as the substrate and there is substantially no trench in the substrate. The reason for this will be explained in greater detail below. Although not shown there are trenches in both the X and Y directions over the wafer separating each chip from the next.

After the wafer has been fabricated and the trenches formed, the wafer is attached to a film, such as a Mylar film (not shown) or UV tape. The film is applied to the cladding layer to hold the chips in place during the next stages of the process. Once supported by the film, the wafer undergoes a process to remove the entire substrate. This could include at least in part a backgrinding process. Using the backgrind, the substrate is reduced to about 50 µm (± 25µm) from its original thickness, to ensure the total remaining thickness to be about 100 µm, which is a minimum thickness to ensure the backgrind yield is adequate. The amount of substrate removed by the back grinding is selected to be the optimal for preventing damage to the overlying surfaces of the wafer. The resultant device is shown in figure 2. The backgrind process comprises grinding away a portion of the substrate whilst supporting the wafer on the film using a grinder.

The material of the film is ideally not etchable so that the wafer stays in tact during the following wet etch.

In a next stage of the invention the ground wafer undergoes a silicon wet etch process, which removes the remainder to the substrate as shown in figure 2. The wet etch process comprising exposing the substrate silicon to a solution such as Tetramethylammonium hydroxide (TMAH) in order to remove the remaining silicon and automatically separate the chips.

As can be seen in figure 2 the wet etch process removes all material up to the bottom of the deep trenches. The buffer layer is not etched as it is made from non-etchable material. The thickness of the buffer layer is predefined so that the resultant chip is of the required thickness. The resultant device thus has the buffer layer as a support layer, rather than substrate which would normally serve this purpose.

It should be noted that the removal of the substrate leaving the buffer layer later as the support layer for the device can be carried out in one or more different steps. For example, backgrinding and wet etching; in some cases just wet etching; or any other appropriate step or combination of steps.

As a result of the trenches, the individual devices can be easily separated from one another over the area of the wafer. Apart from the film support there is nothing holding the individual chips together once the substrate has been etched away. The individual chips are either held in place by the film (not shown) or if the film is etched can be recuperated post etching.

The method and final resultant chip of the present invention is a photonics chip. However, it will be appreciated that the process could be used for other type of ultra-thin processing method and chips. Including for example the thin devices such as a flexible display.

The present invention may include a number of variations and alternatives to the examples described above. These are intended to be encompassed within the scope of the invention. The invention is specifically for photonic chips but may also be used on other types of device, for example flexible electronic devices.

According to an aspect of the present invention there is provided a semiconductor device comprising a support layer which is formed from a material that is not susceptible to an etching process and which support layer can be deposed in manufacture to a predetermined thickness to thereby precisely control a required thickness of the device.

Preferably, the support layer comprises a buffer layer.

Preferably, the buffer layer comprises SiO2, SiON, SiN.

Claims

1. A semiconductor device comprising a buffer layer and an etch stop layer, wherein the buffer layer comprises at least one of SiO_2, SiON and SiN and is of predetermined thickness, wherein the etch stop layer has been deposited over the buffer layer, wherein the device is less than 50 µm in thickness.

2. The semiconductor device according to claim 1, wherein the buffer layer has a thickness of 20 to 30µm.

3. The semiconductor device according to any preceding claims, wherein the device is a photonic chip.

4. A method of fabricating a plurality of semiconductor devices, the method comprising:

forming a substrate;

forming a buffer layer over the substrate from at least one of SiO_2, SiON and SiN having a predetermined thickness that is related to a required thickness of the semiconductor device;

forming an etch stop layer over the buffer layer:

forming a plurality of devices on the etch stop layer;

forming at least one layer of cladding material on the device;

forming a plurality of trenches in the layers that extend at least down to the substrate;

applying a film over the cladding material;

removing the substrate at least in part using an etching process to separate each device from others on a wafer, wherein the device is less than 50 µm in thickness.

5. The method according to claim 4, further comprising removing the substrate using a combination of a backgrind and wet etch process.

6. The method according to any one of claims 4 to 5, further comprising separating the device by removing the film such that edges of individual device is defined by the trenches.

7. The method according to any one of claims 4 to 6, further comprising forming the trenches around each side of the device.

8. The method according to any one of claims 4 to 7, further comprising controlling the forming of the buffer layer to produce a device having the required thickness.