method with the technical features of claim 1 and a substrate producing system with the technical features of claim 12. Preferred embodiments of the invention follow from the dependent claims.

The invention provides a method of producing a substrate with a functional layer. The functional layer can be a device layer comprising a plurality of devices. The method comprises providing a workpiece having a first surface and a second surface opposite the first surface and forming a modified layer inside the workpiece. The modified layer comprises a plurality of modified regions. The method further comprises, after forming the modified layer inside the workpiece, forming the functional layer on the first surface of the workpiece, and, after forming the functional layer on the first surface of the workpiece, dividing the workpiece along the modified layer, thereby obtaining the substrate with the functional layer. Dividing the workpiece along the modified layer comprises applying an external stimulus to the workpiece.

In the method of the invention, the modified layer formed inside the workpiece comprises a plurality of modified regions. The modified regions are regions of the workpiece which have been modified, e.g., by the application of an external stimulus, such as radiation, for example, by using a laser beam. The modified regions may be regions of the workpiece in which the structure of the workpiece material has been modified. The modified regions may be regions of the workpiece in which the workpiece has been damaged.

By forming the modified layer, comprising the plurality of modified regions, inside the workpiece, the strength of the workpiece in the areas thereof where the modified regions are formed is reduced. Thus, the strength of the workpiece in the areas where the modified regions are formed is smaller than in those areas thereof in which no modified regions are formed. Hence, the modified layer serves as a separation or

Claims

1. A method of producing a substrate with a functional layer, the method comprising:

providing a workpiece having a first surface and a second surface opposite the first surface;

forming a modified layer inside the workpiece, the modified layer comprising a plurality of modified regions;

after forming the modified layer inside the workpiece, forming the functional layer on the first surface of the workpiece; and

after forming the functional layer on the first surface of the workpiece, dividing the workpiece along the modified layer, thereby obtaining the substrate with the functional layer,

wherein dividing the workpiece along the modified layer comprises applying an external stimulus to the workpiece, and

wherein the functional layer is a device layer comprising a plurality of devices.

2. The method according to claim 1, wherein forming the modified layer inside the workpiece comprises applying a laser beam (LB) to the workpiece, wherein the workpiece is made of a material which is transparent to the laser beam (LB) and the laser beam (LB) is applied to the workpiece at least in a plurality of positions along the first surface, in a condition where a focal point (P) of the laser beam (LB) is located at a distance (d) from the first surface in the direction from the first surface towards the second surface.

3. The method according to claim 2, wherein the laser beam (LB) is applied to the workpiece from the side of the first surface of the workpiece.

4. The method according to any one of the preceding claims, wherein the modified layer is formed so as to be substantially parallel to the first surface.

5. The method according to any one of the preceding claims, wherein the modified layer is formed so as to be surrounded by a peripheral workpiece portion in which no modified regions are formed.

6. The method according to claim 5, wherein dividing the workpiece along the modified layer further comprises separating the workpiece at the peripheral workpiece portion.

7. The method according to any one of the preceding claims, further comprising, after dividing the workpiece along the modified layer, grinding and/or polishing a surface of the substrate opposite the first surface where the functional layer is formed.

8. The method according to any one of the preceding claims, further comprising, after dividing the workpiece along the modified layer, grinding and/or polishing a surface of a remainder of the workpiece, the surface being opposite the second surface of the workpiece.

9. The method according to any one of the preceding claims, wherein, after dividing the workpiece along the modified layer, the steps of forming a modified layer, forming a functional layer and dividing the workpiece are repeated one or more times on a remainder of the workpiece, so as to obtain a plurality of substrates with functional layers.

10. The method according to any one of the preceding claims, wherein the modified regions comprise amorphous regions or regions in which cracks are formed, or the modified regions are amorphous regions or regions in which cracks are formed.

11. The method according to any one of the preceding claims, wherein applying the external stimulus to the workpiece comprises or consists of applying an ultrasonic wave to the workpiece and/or applying pressure to the workpiece and/or applying a mechanical force to the workpiece and/or heating the workpiece and/or cooling the workpiece and/or applying a vacuum to the workpiece.

12. A system for producing a substrate with a functional layer, the system comprising:

a support member for supporting a workpiece, the workpiece having a first surface and a second surface opposite the first surface;

a modified layer forming means configured to form a modified layer inside the workpiece, the modified layer comprising a plurality of modified regions;

a functional layer forming means configured to form the functional layer on the first surface of the workpiece, after forming the modified layer inside the workpiece; and

a dividing means configured to divide the workpiece along the modified layer, thereby obtaining the substrate with the functional layer, after forming the functional layer on the first surface of the workpiece,

wherein the dividing means comprises an external stimulus applying means configured to apply an external stimulus to the workpiece , and

wherein the functional layer is a device layer comprising a plurality of devices.