effort.

Embodiments of this invention disclose a method and a device for embossing of a nanostructure with which large-area substrates can be embossed as much as possible without repeating process steps with structures which are as small as possible.

According to a first aspect of the present invention, there is provided a method for embossing of a nanostructure to a stamp surface of a substrate, including: applying a resist onto the stamp surface of the substrate prior to an imprint operation; after the applying of the resist onto the stamp surface, positioning a nanostructure stamp having the nanostructure thereon at a distance from the stamp surface; effecting automatic contact-making of the nanostructure stamp by releasing the nanostructure stamp from the distance at which it is positioned onto the stamp surface to emboss the nanostructure of a nanostructure stamp to the substrate in vacuum or at ambient pressure under inert gas during the imprint operation; and deforming the nanostructure stamp at the distance at which it is positioned with one or more pressure elements during the imprint operation to bring the nanostructure into contact with a partial area of the stamp surface of the substrate from the distance at which the nanostructure stamp is positioned prior to the effecting of the automatic contact-making.

According to a second aspect of the present invention, there is provided a device for embossing of a nanostructure from a nanostructure stamp into a stamp surface of a substrate, including: a resist application module for applying a resist onto the stamp surface of the substrate, a deformation means for prestressing of the nanostructure stamp, wherein the deformation means is exposed to a fluid or a gas, and contact-making means for making contact of a partial area of the stamp surface of the substrate with the nanostructure stamp, wherein the resist application module is separate from the deformation means and the contact-making means.

All combinations of at least two of the features given in the specification, the claims and/or the figures also fall within the scope of the invention. At the given value ranges, values which lie within the indicated limits will also be considered to be disclosed as boundary values and will be claimed in any combination. To the extent features disclosed for the device can also be interpreted as features of the method, they should also be considered as according to the method and vice versa.

The basic idea according to embodiments of this invention is to make contact first with only a partial area of a stamp surface with the nanostructure stamp by prestressing a nanostructure stamp and/or a substrate and then to effect automatic contact-making with the contact surface by releasing the nanostructure

Claims

1. A method for embossing of a nanostructure to a stamp surface of a substrate, comprising:

applying a resist onto the stamp surface of the substrate prior to an imprint operation;

after the applying of the resist onto the stamp surface, positioning a nanostructure stamp having the nanostructure thereon at a distance from the stamp surface;

effecting automatic contact-making of the nanostructure stamp by releasing the nanostructure stamp from the distance at which it is positioned onto the stamp surface to emboss the nanostructure of a nanostructure stamp to the substrate in vacuum or at ambient pressure under inert gas during the imprint operation; and

deforming the nanostructure stamp at the distance at which it is positioned with one or more pressure elements during the imprint operation to bring the nanostructure into contact with a partial area of the stamp surface of the substrate from the distance at which the nanostructure stamp is positioned prior to the effecting of the automatic contact-making.

2. The method of Claim 1, wherein the pressure elements comprise gas.

3. The method of Claim 1, wherein the pressure elements comprise fluid.

4. The method of Claim 1, wherein the pressure elements comprise one of a pin and an actuator.

5. The method of Claim 4, further comprising:

pressurizing the pressure elements with a fluid.

6. The method of Claim 5, further comprising:

pressurizing the pressure elements with a gas.

7. The method of Claim 1, further comprising:

carrying out a separation operation under control of a force sensor during the imprint operation.

8. A device for embossing of a nanostructure from a nanostructure stamp into a stamp surface of a substrate, comprising:

a resist application module for applying a resist onto the stamp surface of the substrate,

a deformation means for prestressing of the nanostructure stamp, wherein the deformation means is exposed to a fluid or a gas, and

contact-making means for making contact of a partial area of the stamp surface of the substrate with the nanostructure stamp,

wherein the resist application module is separate from the deformation means and the contact-making means.

9. The device of Claim 8, further comprising:

a force sensor for controlling detachment of the nanostructure stamp and the stamp surface of the substrate during a separation operation, wherein the separation operation is carried out during the imprint operation.

10. The device of Claim 8, further comprising:

an actuator for mechanically approaching the nanostructure from the nanostructure stamp and the partial area of the stamp surface of the substrate.

11. The device of Claim 8, further comprising:

a pin for mechanically approaching the nanostructure from the nanostructure stamp and the partial area of the stamp surface of the substrate.

12. The device of Claim 10, wherein the actuator is pressurized with a fluid.

13. The device of Claim 10, wherein the actuator is pressurized with a gas.