CLAIMS

1. A method for forming an array of nanostructures, the method comprising the following steps:

providing a layer structure including an array of first sacrificial nanostructures arranged on a supporting layer structure comprising at least a first material layer and a substrate;

selectively applying spacer structures on sidewalls of the array of first sacrificial nanostructures;

selectively etching away the array of first sacrificial nanostructures such that the spacer structures form an array of second sacrificial nanostructures;

etching the first material layer using the array of second sacrificial nanostructures as an etching mask; and

removing the array of second sacrificial nanostructures thereby exposing an array of nanostructures formed from the first material layer,

wherein selectively applying spacer structures on sidewalls of the array of first sacrificial nanostructures comprises a cyclic modification process where each cycle comprises:

isotropic modification of exposed surfaces of the array of first sacrificial nanostructures and of the first material layer, and

anisotropic etching of modified material from top surfaces of the first material layer and the first sacrificial nanostructures,

thereby gradually forming the spacer structures on sidewalls of the array of first sacrificial nanostructures.

2. The method according to claim 1, wherein the isotropic modification comprises one or more of deposition, adsorption, conversion and extraction.

3. The method according to claim 1, wherein the anisotropic etching comprises dry etching.

4. The method according to claim 1, wherein in each cycle of the cyclic modification process the anisotropic etching follows directly after the isotropic surface modification

5. The method according to claim 1, wherein one or more of the cycles of the cyclic modification process further comprises an intermediate step for removal of remaining gases and byproducts, such as pump step, a purge step or their combination.

6. The method according to claim 1, further comprising, during the cyclic modification process, anisotropic etching away material from top surfaces of the first material layer thereby forming an inclination in surfaces forming borders between the spacer structures and the first material layer.

7. The method according to claim 1, further comprising, in between selectively applying spacer structures on sidewalls of the array of first sacrificial nanostructures and selectively etching away the array of first sacrificial nanostructures:

etching away a sublayer of the first material layer using the first sacrificial nanostructures and the spacer structures on the sidewalls of the first material layer as an etching mask; and

selectively applying additional spacer structures on sidewalls of the spacer structures and on the sidewalls of the first material layer exposed by the etching away the sublayer of the first material layer.

8. The method according to claim 7, wherein selectively applying additional spacer structures is made by a cyclic modification process where each cycle comprises:

isotropic modification of exposed surfaces of the array of first sacrificial nanostructures and of the first material layer, and

anisotropic etching of modified material from top surfaces of the first material layer and the first sacrificial nanostructures,

thereby gradually forming the additional spacer structures on sidewalls of the spacer structures.

9. The method according to claim 1, further comprising subjecting the array of nanostructures formed from the first material layer to a cyclic etch process where each cycle comprises subjecting the array of nanostructures to surface modification by one or more of chemisorption, deposition, conversion and extraction and subjecting the array of nanostructures to a particle beam consisting of particles having an energy of less than 1000 eV, wherein the particle beam having a direction being parallel with a surface normal to the substrate within a deviation of ±20°, whereby selective etching of main surfaces of the array of nanostructures relative to walls of the array of nanostructures is achieved such that a recess is formed in each of the nanostructures in the array of nanostructures.

10. The method according to claim 1, wherein all the steps of method are performed in a same processing chamber.