CLAIMS

1. A method for surface conditioning of a patterned surface based on cyclic processing, the method comprising:

activating the patterned surface;

removing excess materials from the patterned surface and surrounding environment;

applying a low-energy particle treatment to the patterned surface, wherein the low-energy particle treatment utilizes a low-energy ion beam with a particle energy between 10 eV and 100 eV and an angled particle beam; and

repeating the above steps until surface structures of the patterned surface has a desired smoothness, wherein the repeating is performed until the process has no further effect on the surface structures of the patterned surface.

2. The method according to claim 1, wherein the low-energy ion treatment is atomic layer etching, ALE.

3. The method according to claim 2, wherein the low-energy ion treatment is ALE with molecular activation.

4. The method according to claim 1, wherein the cyclic processing comprises deposition steps, wherein the deposition steps result in an atomic layer deposition, ALD.

5. The method according to any one of claims 1 to 4, further comprising ion beam shaping technology.

6. The method according to any one of claims 1 to 5, wherein the patterned surface comprises side wall surface structures.

7. The method according to any one of claims 1 to 6, wherein the patterned surface comprises inclined surface structures.

8. The method according to any one of claims 1 to 7, wherein the patterned surface is selected from the group consisting of semiconductor surfaces, metal surfaces, dielectric surfaces, and 2D material surfaces.

9. The method according to any one of claims 1 to 8, wherein the activation of the surface comprises applying a gas exposure to the surface.

10. The method according to any one of claims 1 to 9, wherein the activation of the surface comprises exposing the surface to a chemical solution.

11. The method according to any one of claims 1 to 10, wherein the activation of the surface comprises heating the surface to a specific temperature.

12. The method according to any one of claims 1 to 11, wherein the activation of the surface comprises applying a particle beam to the surface.

13. The method according to any one of claims 1 to 12, wherein the low-energy particle treatment comprises a low-energy plasma treatment with a plasma power between 1 W and 50 W.

14. A surface conditioned by the method according to any one of claims 1 to 13.