

**CLAIMS**

1. An optical device comprising:
  - a stacked structure having a first surface and a second surface opposite the first surface;
  - wherein the stacked structure comprises a plurality of holes or grooves extending from the first surface towards the second surface;
  - wherein the stacked structure comprises a transition metal dichalcogenide material (TMDC) material; and
  - wherein a thickness of the stacked structure is of any value less than 100 nm.
2. The optical device according to claim 1,
  - wherein the stacked structure is of any value equal to or less than 10 nm.
3. The optical device according to claim 1 or claim 2,
  - wherein the stacked structure comprises a plurality of layers of the transition metal dichalcogenide material (TMDC) material.
4. The optical device according to any one of claims 1 to 3,
  - wherein the transition metal dichalcogenide material (TMDC) material is molybdenum disulfide ( $\text{MoS}_2$ ).
5. The optical device according to any one of claims 1 to 4,
  - wherein the optical device is a super oscillatory lens (SOL), a super-critical lens (SCL), or a Fresnel zone plate.
6. The optical device according to claim 5,
  - wherein the plurality of grooves forms a plurality of concentric ring structures.
7. The optical device according to claim 5 or claim 6,

wherein the optical device is configured to generate a sub-diffraction limit focusing spot upon light incident onto the optical device such that the sub-diffraction limit focusing spot is of a full width at half maximum (FWHM) equal to or less than 0.515 times of a wavelength of the light divided by a numerical aperture of the optical device.

8. The optical device according to any one of claims 1 to 4,  
wherein the optical device is a photon sieve.
9. The optical device according to claim 8,  
wherein the plurality of holes extends from the first surface of the stacked structure to the second surface of the stacked structure.
10. The optical device according to claim 9,  
wherein a total efficiency when light is incident onto the photon sieve at an angle  $30^\circ$  is at a value more than 75% of a total efficiency when light is incident onto the photon sieve along the normal.
11. A method of forming an optical device, the method comprising:  
forming a plurality of holes or grooves extending from a first surface of a stacked structure towards a second surface of the stacked structure opposite the first surface;  
wherein the stacked structure comprises a transition metal dichalcogenide material (TMDC) material; and  
wherein a thickness of the stacked structure is of any value less than 100 nm.
12. The method according to claim 11,  
wherein the thickness of the stacked structure is of any value equal to or less than 10 nm.
13. The method according to claim 11 or claim 12, further comprising:

forming the stacked structure on a substrate via physical vapor deposition or chemical vapor deposition before forming the plurality of holes or grooves.

14. The method according to claim 13, further comprising:  
depositing a mask layer on the stacked structure after forming the stacked structure and before forming the plurality of holes or grooves.
15. The method according to claim 14,  
wherein the mask layer comprises a metal, a polymer or a dielectric material.
16. The method according to claim 15,  
wherein the metal is gold or chromium.
17. The method according to claim 15,  
wherein the polymer is poly(methyl methacrylate) or photoresist.
18. The method according to claim 15,  
wherein the dielectric material is silicon oxide ( $\text{SiO}_2$ ) or aluminum oxide ( $\text{Al}_2\text{O}_3$ ).
19. The method according to any one of claims 14 to 18,  
wherein the plurality of holes or grooves are formed by etching through the mask layer.
20. The method according to claim 19,  
wherein the etching is focused ion beam (FIB) etching, plasma etching, or reactive ion etching.
21. The method according to claim 19 or claim 20, further comprising:  
removing the mask layer from the stacked structure after forming the plurality of holes or grooves on the stacked structure.

22. The method according to any one of claims 11 to 21,  
wherein the optical device is a super oscillatory lens (SOL), a super-critical  
lens (SCL), or a Fresnel zone plate.
23. The method according to any one of claims 11 to 21,  
wherein the optical device is a photon sieve.