

What is claimed is:

1. A method of manufacturing an extreme ultraviolet (EUV) mask blank, the method comprising:
 - 5 depositing a first layer on a portion of a chamber interior of a multi-cathode physical vapor deposition (PVD) chamber;
depositing a second layer on the first layer to form a bilayer selected from the group consisting of a $\text{SiN}_x/\text{SiO}_x\text{N}_y$ bilayer, a SiN_x/Mo bilayer, a SiN_x/Al bilayer, a $\text{SiN}_x/\text{MoSi}_x$ bilayer, a $\text{SiN}_x/\text{AlSi}_x$ bilayer, a $\text{SiN}_x/\text{Mo}_x\text{Al}_y$ bilayer, a $\text{SiO}_x\text{N}_y/\text{Mo}$ bilayer, a $\text{SiO}_x\text{N}_y/\text{Al}$ bilayer, a $\text{SiO}_x\text{N}_y/\text{MoSi}_x$ bilayer, a $\text{SiO}_x\text{N}_y/\text{AlSi}_x$ bilayer, and a $\text{SiO}_x\text{N}_y/\text{Mo}_x\text{Al}_y$ bilayer;
10 placing a substrate in the multi-cathode physical vapor deposition (PVD) chamber; and
forming a multilayer stack of alternating layers of molybdenum and silicon on
15 the substrate.
2. The method of claim 1, wherein the first layer is a SiN_x layer, the second layer is a SiO_xN_y layer, and the multi-cathode PVD chamber comprises a first silicon target, a second silicon target, a third silicon target and a fourth molybdenum target.
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3. The method of claim 2, further comprising flowing a mixture of Ar/N_2 gas in the PVD chamber and sputtering from the first silicon target to form a SiN_x layer on the portion of the chamber interior.
- 25 4. The method of claim 3, further comprising flowing a mixture of $\text{Ar}/\text{N}_2/\text{O}_2$ gas in the PVD chamber and sputtering the second silicon target to a SiO_xN_y layer on the SiN_x layer to form a $\text{SiN}_x/\text{SiO}_x\text{N}_y$ bilayer.
5. The method of claim 4, further comprising forming a range of from 3 to 10
30 $\text{SiN}_x/\text{SiO}_x\text{N}_y$ bilayers before placing the substrate in the multi-cathode PVD chamber.
6. The method of claim 5, wherein the portion of the chamber interior comprises a liner.

7. The method of claim 6, wherein the liner comprises a shield.
8. The method of claim 6, further comprising rotating the liner while forming each
5 of the SiN_x layer and the SiO_xN_y layer.
9. The method of claim 8, wherein the liner is not rotated during formation of the multilayer stack of alternating layer of molybdenum and silicon on the substrate.
- 10 10. A method of manufacturing an extreme ultraviolet (EUV) mask blank, the method comprising:
rotating a liner of a multi-cathode physical vapor deposition (PVD) chamber;
depositing a first layer on the liner while the liner is rotating;
depositing a second layer on the first layer while the liner is rotating to form a
15 bilayer selected from the group consisting of a $\text{SiN}_x/\text{SiO}_x\text{N}_y$ bilayer, a SiN_x/Mo bilayer, a SiN_x/Al bilayer, a $\text{SiN}_x/\text{MoSi}_x$ bilayer, a $\text{SiN}_x/\text{AlSi}_x$ bilayer, a $\text{SiN}_x/\text{Mo}_x\text{Al}_y$ bilayer, a $\text{SiO}_x\text{N}_y/\text{Mo}$ bilayer, a $\text{SiO}_x\text{N}_y/\text{Al}$ bilayer, a $\text{SiO}_x\text{N}_y/\text{MoSi}_x$ bilayer, a $\text{SiO}_x\text{N}_y/\text{AlSi}_x$ bilayer, and a $\text{SiO}_x\text{N}_y/\text{Mo}_x\text{Al}_y$ bilayer;
stopping rotation of the liner;
20 placing a substrate in the multi-cathode physical vapor deposition (PVD) chamber including a chamber interior; and
forming a multilayer stack of alternating layers of molybdenum and silicon on the substrate.
- 25 11. The method of claim 10, wherein the first layer is a SiN_x layer, the second layer is a SiO_xN_y layer, and the multi-cathode PVD chamber comprises a first silicon target, a second silicon target, a third silicon target and a fourth molybdenum target.
- 30 12. The method of claim 11, further comprising flowing a mixture of Ar/N_2 gas in the PVD chamber and sputtering from the first silicon target to form a SiN_x layer on the liner.

13. The method of claim 12, further comprising flowing a mixture of Ar/N₂/O₂ gas in the PVD chamber and sputtering the second silicon target to a SiO_xN_y layer on the SiN_x layer to form a SiN_x/ SiO_xN_y bilayer.
- 5 14. The method of claim 13, further comprising forming a range of from 3 to 10 SiN_x/SiO_xN_y bilayers before placing the substrate in the multi-cathode PVD chamber.
15. The method of claim 11, wherein the liner is rotated so that deposition of each of the SiO_xN_y layer and the SiN_x layer occurs during 3 to 5 full cycles of liner rotation.
- 10 16. The method of claim 15, further comprising controlling rotation speed of the liner to up to 20 rpm.
17. A multi-cathode physical vapor deposition (PVD) chamber comprising:
- 15 a first silicon target, a second silicon target, a third silicon target and a molybdenum target;
- a liner lining an interior of the PVD chamber, the liner configured to rotate; and
- a controller configured to control rotation of the liner during deposition of a first layer on the liner when the first silicon target is sputtered and during deposition of a
- 20 second layer on the first layer to form a bilayer selected from the group consisting of a SiN_x/SiO_xN_y bilayer, a SiN_x/Mo bilayer, a SiN_x/Al bilayer, a SiN_x/MoSi_x bilayer, a SiN_x/AlSi_x bilayer, a SiN_x/Mo_xAl_y bilayer, a SiO_xN_y/Mo bilayer, a SiO_xN_y/Al bilayer, a SiO_xN_y/MoSi_x bilayer, a SiO_xN_y/AlSi_x bilayer, and a SiO_xN_y/Mo_xAl_y bilayer when the second silicon target is sputtered.
- 25 18. The multi-cathode physical vapor deposition (PVD) chamber of claim 17, wherein the controller is configured to form 3 to 8 bilayers.
19. The multi-cathode physical vapor deposition (PVD) chamber of claim 17,
- 30 wherein the controller is configured to stop rotation of the liner prior to loading of a substrate into the chamber.
20. The multi-cathode physical vapor deposition (PVD) chamber of claim 19, wherein the controller is configured to form a multilayer stack of alternating layers of

molybdenum and silicon on the substrate by alternately sputtering a third silicon target and a fourth molybdenum target.