CLAIMS

1. A method of manufacturing an extreme ultraviolet (EUV) mask blank comprising:
forming a multilayer stack of reflective layers on a substrate, the multilayer stack of reflective layers including a plurality of reflective layer pairs;
forming a capping layer on the multilayer stack of reflective layers;
forming an absorber comprising a tuning layer for tuning an absorption by tuning a thickness thereof and a stack of absorber layers comprising forming the tuning layer on the capping layer, the tuning layer having a tuning layer thickness t_{TL}; and
forming the stack of absorber layers on the capping layer, the stack of absorber layers including periodic bilayers of a first material A having a thickness t_A and a refractive index n_A and a second material B having a thickness t_B and a refractive index n_B, wherein each bilayer defines a period having a thickness $t_P = t_A + t_B$, the first material A and the second material B are different materials, wherein there is a difference in magnitude of n_A and n_B greater than 0.01, and the stack of absorber layers comprises N periods, and the thickness of the absorber $t_{abs} = N*t_P + t_{TL}$,
wherein t_{abs} is less than 30 nm.

2. The method of claim 1, wherein the plurality of reflective layer pairs are made from a material selected from molybdenum (Mo) containing material and silicon (Si) containing material and the first material A and the second material B are made from a material selected from the group consisting of platinum (Pt), zinc (Zn), gold (Au), nickel (Ni), silver (Ag), iridium (Ir), iron (Fe), tin (Sn), cobalt (Co), copper (Cu), silver (Ag), actinium (Ac), tellurium (Te), antimony (Sb), tantalum (Ta), chromium (Cr), aluminum (Al), germanium (Ge), magnesium (Mg), tungsten (W), carbon (C), gallium (Ga), and boron (B), and alloys, carbides, borides, nitrides, silicides, and oxides thereof.

3. The method of claim 1, wherein the tuning layer comprises the first material A or the second material B and has a thickness that is different than t_A and wherein adjusting the thickness provides a tunable absorption for the absorber.

4. The method of claim 1, wherein the first material A comprises Ag or Sb and the second material B comprises Te, Ta, or Ge.

5. The method of claim 1, wherein the first material A comprises Ag or GaSb and the second material B comprises ZnTe.

6. The method of claim 1, wherein t_A is in a range of from 1 nm to 5 nm and t_B is in a range of from 1 nm to 5 nm.

7. The method of claim 1, wherein N is in a range of from 1 to 10.

8. An extreme ultraviolet (EUV) mask blank comprising:
a substrate;
a multilayer stack of reflective layers on the substrate, the multilayer stack of reflective layers including a plurality of reflective layer pairs;
a capping layer on the multilayer stack of reflecting layers;
an absorber comprising a tuning layer for tuning an absorption by tuning a thickness thereof and a stack of absorber layers comprising forming the tuning layer on the capping layer, the tuning layer having a tuning layer thickness t_{TL}; and
the stack of absorber layers including periodic bilayers of a first material A having a thickness t_A and a refractive index n_A and a second material B having a thickness t_B and a refractive index n_B, wherein each bilayer defines a period having a thickness $t_P = t_A + t_B$, the first material A and the second material B are different materials, wherein there is a difference in magnitude of n_A and n_B greater than 0.01, and the stack of absorber layers comprises N periods, wherein N is in a range of from 1 to 10, and the thickness of the absorber $t_{abs} = N*t_P + t_{TL}$,
wherein t_{abs} is less than 30 nm.

9. The extreme ultraviolet (EUV) mask blank of claim 8, wherein the plurality of reflective layer pairs are made from a material selected from molybdenum (Mo) containing material and silicon (Si) containing material and the first material A and the second material B are made from a material selected from the group consisting of platinum (Pt), zinc (Zn), gold (Au), nickel (Ni), silver (Ag), iridium (Ir), iron (Fe), tin (Sn), cobalt (Co), copper (Cu), silver (Ag), actinium (Ac), tellurium (Te), antimony (Sb), tantalum (Ta),

chromium (Cr), aluminum (Al), germanium (Ge), magnesium (Mg), tungsten (W), carbon (C), gallium (Ga), and boron (B), and alloys, carbides, borides, nitrides, silicides, and oxides thereof.

10. The extreme ultraviolet (EUV) mask blank of claim 8, wherein the tuning layer comprises the first material A or the second material B and has a thickness that is different than t_A and wherein adjusting the thickness provides a tunable absorption for the absorber.

11. The extreme ultraviolet (EUV) mask blank of claim 8, wherein the first material A comprises Ag or Sb and the second material B comprises Te, Ta, or Ge.

12. The extreme ultraviolet (EUV) mask blank of claim 8, wherein the first material A comprises Ag or GaSb and the second material B comprises ZnTe.

13. The extreme ultraviolet (EUV) mask blank of claim 8, wherein t_A is in a range of from 1 nm to 5 nm and t_B is in a range of from 1 nm to 5 nm and N is in a range of from 1 to 10.