CLAIMS

1. A method of manufacturing of an extreme ultraviolet mask blank comprising:

forming a glass-ceramic substrate from a glass-ceramic block, the glass-ceramic block having a high spatial frequency roughness (HSFR) value;

forming a liquid planarization layer on the glass-ceramic substrate using flowable chemical vapor deposition; and

curing the planarization layer to form a hardened planarization layer,

wherein the hardened planarization layer has a surface roughness of under 0.6 nm rms and an HSFR value lower than the HSFR value of the glass-ceramic substrate.

2. The method as claimed in claim 1 wherein the planarization layer comprises silicon, oxygen, and carbon.

3 The method as claimed in claim 1 wherein curing comprises using an ultraviolet curing process.

4. The method as claimed in claim 1 wherein the glass-ceramic substrate has a coefficient of thermal expansion of $\pm$ 0.007 x 10^{-7}/K.

5. The method of claim 1, wherein forming the planarization layer includes depositing a layer comprising silicon, oxygen, and carbon and curing the layer to form the hardened planarization layer on the glass-ceramic substrate.

6. The method of claim 5 wherein the glass-ceramic substrate has a coefficient of thermal expansion of $\pm$ 0.007 x 10^{-7}/K.

7. The method of claim 5, wherein the hardened planarization layer planarizes a surface of the glass-ceramic substrate without changing properties the glass-ceramic substrate.

8. The method of claim 5, wherein curing comprises steam or ozone curing.

9. The method of claim 5, wherein curing comprises ultraviolet curing.

10. The method of claim 5, wherein the glass-ceramic substrate comprises lithium alumino-silicate.

11. The method of claim 5, further comprising forming a multilayer stack which reflects extreme ultraviolet light on the hardened planarization layer.

12. The method of claim 1, wherein the planarization layer is a SiN based film, the method further comprising converting the SiN based film to a SiO/SiO_2 hardened planarization layer.

13. The method of claim 1, wherein the glass-ceramic substrate comprises lithium alumino-silicate.

14. The method of claim 1 further comprising forming a multilayer stack which reflects extreme ultraviolet light on the hardened planarization layer.