CLAIMS

1. A method for protecting a lithographically-defined plasmonic nanostructure during annealing comprising:

encapsulating the lithographically-defined plasmonic nanostructure in a heat resistant material ~~during~~ before the annealing; and

unencapsulating the lithographically-defined plasmonic nanostructure after annealing.

~~2. The method of claim 1 further comprising unencapsulating the lithographically-defined plasmonic nanostructure after annealing.~~

~~3.~~2. The method of claim 1, wherein the heat resistant material comprises a high temperature resistant material that is stable within a temperature range of 400 °C to 2000 °C.

~~4.~~3. The method of claim ~~3~~2, wherein the high temperature resistant material comprises a high temperature resistant material selected from cross-linked hydrogen silsesquioxane (HSQ), SiO_2, carbon, diamond like carbon and glass.

~~5.~~4. The method of claim 1, wherein the heat resistant material comprises a material that is removable without affecting the lithographically-defined plasmonic nanostructure.

~~6.~~5. The method of claim 1, further comprising annealing at a high temperature sufficient to induce grain boundary motion and recrystallization in the lithographically-defined plasmonic nanostructure.

~~7.~~6. The method of claim 1, wherein the step of encapsulating the plasmonic nanostructure in a heat resistant material during annealing enhances Q factor of the lithographically-defined plasmonic nanostructure.

~~8.~~7. A method for plasmonic structure manufacture comprising:

lithographically forming a plasmonic nanostructure on a substrate;

encapsulating the plasmonic nanostructure in heat resistant material;

annealing the plasmonic nanostructure; and

removing the heat resistant material to reveal the annealed plasmonic nanostructure.

~~9.~~8. The method of claim ~~8~~7, wherein the heat resistant material comprises high temperature resistant materials that are stable with a temperature range of 400 ℃ to 2000℃.

~~10.~~9. The method of claim ~~9~~8, wherein the high temperature resistant material comprises a high temperature resistant material selected from cross-linked hydrogen silsesquioxane (HSQ), SiO_2, carbon, diamond like carbon and glass.

~~11.~~10. The method of claim ~~8~~7, wherein the heat resistant material comprises a material is removable without affecting the plasmonic nanostructure.

~~12.~~11. The method of claim ~~8~~7, wherein the nanostructure is formed from a metal material.

~~13.~~12. The method of claim ~~12~~11, wherein the metal material comprises a material selected from the group comprising Au, Ag, Al, Cu and Cr.

~~14.~~13. The method of claim ~~8~~7, wherein the step of encapsulating comprises encapsulating the plasmonic nanostructure having a first Q factor in heat resistant material, wherein the step of annealing comprises annealing the plasmonic nanostructure to form a plasmonic nanostructure having a second Q factor, wherein the second Q factor is greater than the first Q factor.

~~15.~~14. The method of claim ~~8~~7, wherein the step of lithographically forming a plasmonic nanostructure comprises lithographically forming the plasmonic nanostructure directly on the substrate without an adhesion layer therebetween.

~~16.~~15. The method of claim ~~8~~7, wherein the step of lithographically forming a plasmonic nanostructure comprises lithographically forming the plasmonic nanostructure directly on the substrate without a Cr layer therebetween.

~~17.~~16. The method of claim ~~8~~7, wherein the step of lithographically forming a plasmonic nanostructure comprises lithographically forming the plasmonic nanostructure using a lithographic method selected from the group comprising electron-beam lithography, nanoimprint lithography and photolithography.

~~18.~~17. The method of claim ~~17~~16, wherein the step of lithographically forming a plasmonic nanostructure comprises lithographically forming the plasmonic nanostructure using the lithographic method combined with a metallization method selected from the group comprising electron beam physical vapor deposition, evaporation deposition.