CLAIMS

1. A method comprising:

providing a substrate having a gap to a processing chamber, the substrate having a top surface with the gap recessed from the top surface;

performing multiple plasma-enhanced atomic layer deposition (PEALD) cycles to fill the gap with a first dielectric film, wherein the first dielectric film is characterized by a first indentation over the gap and above the plane of the top surface; and

in the processing chamber, depositing a second dielectric film over the first dielectric film by a plasma enhanced chemical vapor deposition (PECVD) process.

2. The method of claim 1, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 10% smaller than the first indentation.

3. The method of claim 1, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 20% smaller than the first indentation.

4. The method of claim 1, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 30% smaller than the first indentation.

5. The method of any of claims 1–4, wherein the second dielectric film is between 1 and 3 microns thick.

6. The method of any of claims 1–5, wherein the processing chamber is a multi-station processing chamber.

7. The method of claim 6, wherein the multiple PEALD cycles are performed in one or more first stations of the multi-station processing chamber and the PECVD process is performed in one or more second stations of the multi-station processing chamber, the first station being different stations than the second stations.

8. The method of any of claims 1–7, wherein after deposition of the second dielectric film, the substrate is ready for chemical-mechanical planarization (CMP).

9. The method of any of claims 1–8, further comprising, performing a CMP process to form a planarized surface comprising one or both of the first and second dielectric films.

10. A method comprising:

providing a substrate having a gap to a processing chamber, the substrate having a top surface with the gap recessed from the top surface;

performing multiple atomic layer deposition (ALD) cycles to fill the gap with a first dielectric film, wherein the first dielectric film is characterized by a first indentation over the gap and above the plane of the top surface; and

in the processing chamber, depositing a second dielectric film over the first dielectric film by a chemical vapor deposition (CVD).

11. The method of claim 10, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 10% smaller than the first indentation.

12. The method of claim 10, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 20% smaller than the first indentation.

13. The method of claim 10, wherein the second dielectric film fills the first indentation and comprises a second indentation that is at least 30% smaller than the first indentation.

14. The method of any of claims 10–13, wherein the second dielectric film is between 1 and 3 microns thick.

15. The method of any of claims 9–14, wherein the processing chamber is a multi-station processing chamber.

16. The method of claim 15, wherein the multiple PEALD cycles are performed in one or more first stations of the multi-station processing chamber and the PECVD process is performed in one or more second stations of the multi-station processing chamber, the first station being different stations than the second stations.

17. The method of any of claims 9–16, wherein after deposition of the second dielectric film, the substrate is ready for chemical-mechanical planarization (CMP).

18. The method of any of claims 9–17, further comprising, performing a CMP process to form a planarized surface comprising one or both of the first and second dielectric films.

19. An apparatus comprising:

a first station comprising a substrate support, a showerhead, and a plasma generator configured to generate a plasma between the substrate support and the showerhead;

a reactant delivery system for delivering reactants to the first station; and a controller comprising machine readable instructions for:

performing multiple plasma-enhanced atomic layer deposition (PEALD) cycles in the first station to fill a gap with a first dielectric film, wherein the first dielectric film is characterized by a first indentation over the gap and above the plane of the top surface; and

depositing a second dielectric film over the first dielectric film by a plasma enhanced chemical vapor deposition (PECVD) process.

20. The apparatus of claim 19, further comprising a second station comprising a substrate support, a showerhead, and a plasma generator configured to generate a plasma between the substrate support and the showerhead, wherein the controller comprises machine readable instructions for transferring the substrate from the first station to the second station, and wherein instructions for depositing the second dielectric film comprise instructions for depositing the second dielectric film in the second station.

21. The apparatus of claim 19, wherein instructions for depositing the second dielectric film comprise instructions for depositing the second dielectric film in the first station.