CLAIMS:

1. A fabrication tool, comprising:

a chamber;

a pedestal electrode and a showerhead electrode arranged in the chamber;

one or more gas inlets into the chamber and associated flow control hardware;

a vacuum pump system configured to reduce a pressure within the chamber;

a radiofrequency (RF) power source configured to form an RF plasma between the pedestal electrode and the showerhead electrode; and

coupled operatively to the flow control hardware and to the RF power source, a controller comprising a processor and memory, the memory comprising instructions executable by the processor to:

operate the flow control hardware to introduce a hydrogen-containing reducing agent into the chamber,

operate the flow control hardware to introduce a hydrocarbon gas into the chamber, and

operate the RF power source to form a plasma between the pedestal electrode and the showerhead electrode to fully deposit a carbon plug in a recess of a workpiece positioned on a pedestal of the chamber in a single plasma deposition cycle with no intermediate carbon removal process.

2. The fabrication tool of claim 1, wherein the instructions are executable to operate the RF power source to provide RF power at one or more frequencies within a range of five megahertz and higher.

3. The fabrication tool of claim 2, wherein the instructions are executable to operate the RF power source to provide RF power that excludes frequencies below five megahertz.

4. The fabrication tool of claim 1, wherein the hydrocarbon gas comprises an alkyne.

5. The fabrication tool of claim 4, wherein the alkyne comprises acetylene.

6. The fabrication tool of claim 1, wherein the instructions are executable to operate the flow control hardware to introduce the hydrogen-containing reducing agent and the hydrocarbon gas into the chamber at a molar ratio of 20-35% hydrogen.

7. The fabrication tool of claim 1, wherein the instructions are further executable to further introduce one or more of argon or nitrogen into the chamber as a diluent gas.

8. The fabrication tool of claim 1, wherein the instructions are further executable to operate the flow control hardware to deposit the carbon plug at a processing gas pressure between 5 and 13 Torr.

9. The fabrication tool of claim 1, further comprising one or more heaters, and wherein the instructions are executable to operate the one or more heaters to maintain the pedestal electrode at a temperature within 275-660 °C during plug formation.

10. The fabrication tool of claim 1, wherein the instructions are executable to extinguish the plasma after the workpiece is exposed to the plasma for a duration within a range of 700 to 1800 seconds.

11. An integrated circuit fabrication method, comprising:

forming a carbon plug in a recess of a workpiece in a single plasma deposition cycle by exposing the workpiece to a carbon-depositing plasma in a plasma processing chamber, the plasma formed from a mixture of gases comprising

a hydrogen-containing reducing agent, and

a hydrocarbon gas.

12. The integrated circuit fabrication method of claim 11, wherein the carbon-depositing plasma comprises a radiofrequency (RF) plasma, the RF plasma comprising one or more frequencies within a range of five megahertz and higher.

13. The integrated circuit fabrication method of claim 11, wherein the hydrocarbon gas comprises an alkyne.

14. The integrated circuit fabrication method of claim 11, wherein the hydrogen-containing reducing agent and the hydrocarbon gas are introduced into the chamber at a molar ratio of 20-35% hydrogen.

15. The integrated circuit fabrication method of claim 11, wherein the mixture of gases further comprises one or more of argon or nitrogen as a diluent gas.

16. The integrated circuit fabrication method of claim 11, wherein the carbon plug is formed at a processing gas pressure between 5 and 13 Torr.

17. The integrated circuit fabrication method of claim 11, further comprising planarizing the workpiece after the single plasma deposition cycle, thereby removing carbon deposited outside of the recess.

18. The integrated circuit fabrication method of claim 11, wherein the recess comprises a channel of a memory stack structure.

19. A integrated circuit fabrication method of fabricating a memory stack structure, the method comprising:

supporting a workpiece on a pedestal of a deposition chamber, the deposition chamber comprising a pedestal electrode separated from a showerhead electrode by an interelectrode space, the workpiece comprising a recess in a first memory deck;

flowing a mixture of gases through the deposition chamber at reduced pressure, the mixture of gases comprising a hydrogen-containing reducing agent, and also comprising a hydrocarbon;

driving RF current through a discharge gap between the pedestal electrode and the showerhead electrode to form a carbon-depositing plasma and deposit a carbon plug in the recess in the first memory deck in a single deposition cycle;

planarizing the workpiece after forming the carbon plug in the recess in the first memory deck in the single deposition cycle; and

depositing layers of a second memory deck over the first memory deck and the carbon plug.

20. The integrated circuit fabrication method of claim 19, wherein the hydrocarbon comprises an alkyne.