

Claims:

1. A method of processing a substrate, comprising:
 - depositing a carbon hardmask over a film stack formed on the substrate, wherein the substrate is positioned on an electrostatic chuck disposed in a process chamber;
 - implanting ions into the carbon hardmask, wherein depositing the carbon hardmask and implanting ions into the carbon hardmask are performed in the same process chamber; and
 - repeating depositing the carbon hardmask and implanting ions into the carbon hardmask in a cyclic fashion until a pre-determined thickness of the carbon hardmask is reached.
2. The method of claim 1, wherein depositing the carbon hardmask is performed by applying a first RF power having a first power level to the electrostatic chuck via a first electrode disposed in the electrostatic chuck.
3. The method of claim 2, wherein the first RF power is in a range of about 1 Kilowatts to about 10 Kilowatts at a frequency of about 0.4 MHz to about 300 MHz.
4. The method of claim 2, wherein implanting ions into the carbon hardmask further comprising:
 - after depositing the carbon hardmask over the film stack, discontinuing a flow of a hydrocarbon-containing gas for forming the carbon hardmask; and
 - reducing the first RF power from the first power level to a second power level that is sufficient to sustain plasma in the process chamber.
5. The method of claim 1, wherein implanting ions into the carbon hardmask is performed by applying a DC bias voltage to the electrostatic chuck via a second electrode disposed in the electrostatic chuck.
6. The method of claim 5, wherein the DC bias voltage is in a range of about 2 Kilovolts to about 15 Kilovolts.

7. The method of claim 5, wherein the DC bias voltage is provided at a pulse frequency of 10 Hz to about 10 kHz with a pulse width of about 5 microseconds to about 30 milliseconds.
8. The method of claim 1, wherein implanting ions into the carbon hardmask is performed by applying a second RF power to the electrostatic chuck via a third electrode disposed in the electrostatic chuck.
9. The method of claim 8, wherein the second RF power is in a range of about 1 Kilowatts to about 10 Kilowatts at a frequency of about 0.4 MHz to about 300 MHz.
10. The method of claim 9, wherein the second RF power is pulsed with a duty cycle in a range from about 10 % to about 80 %.
11. A method of processing a substrate, comprising:
 - depositing a carbon hardmask over a substrate, wherein the carbon hardmask is deposited by applying a RF bias to an electrostatic chuck upon which the substrate is positioned to generate a plasma; and
 - while depositing the carbon hardmask over the substrate, implanting ions from the plasma into the carbon hardmask using the RF bias, wherein depositing the carbon hardmask and implanting ions into the carbon hardmask are simultaneously performed in the same process chamber.
12. The method of claim 11, wherein the RF bias is in a range from about 1 Kilowatts to about 15 Kilowatts at a frequency of about 0.4 MHz to about 300 MHz.
13. The method of claim 11, wherein the RF bias provides an implant energy of about 6 keV to about 45 keV.
14. The method of claim 11, further comprising:
 - while depositing the carbon hardmask over the substrate, applying a DC bias voltage to the electrostatic chuck.

15. The method of claim 14, wherein the DC bias voltage is in a range of about 1 Kilovolts to about 15 Kilovolts.