

CLAIMS

1. A plasma etch chamber, comprising: a plasma source disposed in an upper region of the plasma etch chamber; and a cathode assembly disposed below the plasma source, the cathode assembly comprising: a cooling RF-powered chuck for supporting an inner portion of a backside of a substrate carrier directly thereon; a cooling RF-isolated support surrounding but isolated from the cooling RF-powered chuck, the cooling RF-isolated support for supporting an outer portion of the backside of the substrate carrier directly thereon; and an RF rod that passes through an opening in the cooling RF-isolated support, wherein the RF rod contacts the cooling RF-powered chuck but does not contact the cooling RF-isolated support.
2. The plasma etch chamber of claim 1, wherein the cooling RF-powered chuck and the cooling RF-isolated support have a common heat transfer fluid loop.
3. The plasma etch chamber of claim 1, wherein the cooling RF-powered chuck and the cooling RF-isolated support are configured to be maintained at a temperature below 0 degrees Celsius during plasma processing.
4. The plasma etch chamber of claim 1, further comprising: a shadow ring assembly configured to be positioned between the cathode assembly and the plasma source during plasma processing.
5. A method of dicing a semiconductor wafer comprising a plurality of integrated circuits, the method comprising: introducing a substrate supported by a substrate carrier into a plasma etch chamber, the substrate having a patterned mask thereon covering integrated circuits and exposing streets of the substrate, and the substrate carrier having a backside; supporting an inner portion of the backside of the substrate carrier directly on a cooling RF-powered chuck of a cathode assembly housed in the plasma etch chamber, and supporting an outer portion of the backside of the substrate carrier directly on a cooling RF-isolated support surrounding but isolated from the cooling RF-powered chuck, wherein the RF-powered chuck is powered by an RF rod that passes through an opening in the cooling RF-isolated support, and wherein the RF rod contacts the cooling RF-powered chuck but does not contact the cooling RF-isolated support; cooling the backside of the substrate carrier with both the cooling RF-powered chuck and the cooling RF-isolated support; and plasma etching the substrate through the streets to singulate the integrated circuits while performing the cooling of the backside of the substrate carrier.
6. The method of claim 5, wherein cooling the backside of the substrate carrier with both the cooling RF-powered chuck and the cooling RF-isolated support comprises flowing a cooling fluid through a heat transfer fluid loop common to both the both the cooling RF-powered chuck and the cooling RF-isolated support.
7. The method of claim 5, wherein, during the plasma etching, both the cooling RF-powered chuck and the cooling RF-isolated support are maintained at a temperature below 0 degrees Celsius.
8. The method of claim 5, wherein the substrate carrier comprises an outer tape frame and

supporting dicing tape having a substrate region, and wherein cooling the backside of the substrate carrier comprises cooling the tape frame and the substrate region of the dicing tape.

9. The method of claim 8, wherein the cooling RF-powered chuck cools the substrate region of the dicing tape, and the cooling RF-isolated support cools the tape frame.

10. The method of claim 9, wherein a portion of the dicing tape is disposed between the tape frame and the cooling RF-isolated support.

11. The method of claim 5, wherein, during the plasma etching, a portion of a front side of the substrate carrier is protected by a shadow ring.

12. The method of claim 5, further comprising: forming the patterned mask with a laser scribing process.

13. A system for dicing a semiconductor wafer comprising a plurality of integrated circuits, the system comprising: a factory interface; a laser scribe apparatus coupled with the factory interface and comprising a laser assembly; and a plasma etch chamber coupled with the factory interface, the plasma etch chamber comprising a cathode assembly disposed below a plasma source, the cathode assembly comprising: a cooling RF-powered chuck for supporting an inner portion of a backside of a substrate carrier directly thereon; a cooling RF-isolated support surrounding but isolated from the cooling RF-powered chuck, the cooling RF-isolated support for supporting an outer portion of the backside of the substrate carrier directly thereon; and an RF rod that passes through an opening in the cooling RF-isolated support, wherein the RF rod contacts the cooling RF-powered chuck but does not contact the cooling RF-isolated support.

14. The system of claim 13, wherein the cooling RF-powered chuck and the cooling RF-isolated support of the cathode assembly of the plasma etch chamber have a common heat transfer fluid loop.

15. The system of claim 13, wherein the cooling RF-powered chuck and the cooling RF-isolated support of the cathode assembly of the plasma etch chamber are configured to be maintained at a temperature below 0 degrees Celsius during plasma processing.

16. The system of claim 13, wherein the cathode assembly of the plasma etch chamber further comprises a shadow ring assembly configured to be positioned between the cathode assembly and the plasma source during plasma processing.