

Exhibit E
in support of the
**Declaration of Olivia
Weber**



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(12) **United States Patent**
Hoffman et al.

(10) **Patent No.:** **US 9,593,411 B2**
 (45) **Date of Patent:** **Mar. 14, 2017**

(54) **PHYSICAL VAPOR DEPOSITION CHAMBER WITH CAPACITIVE TUNING AT WAFER SUPPORT**

(56) **References Cited**

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(73) Assignee: **APPLIED MATERIALS, INC.**, Santa Clara, CA (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 618 days.

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 (74) *Attorney, Agent, or Firm* — Moser Taboada; Alan Taboada

Related U.S. Application Data

(63) Continuation of application No. 12/077,067, filed on Mar. 14, 2008.

(57) **ABSTRACT**

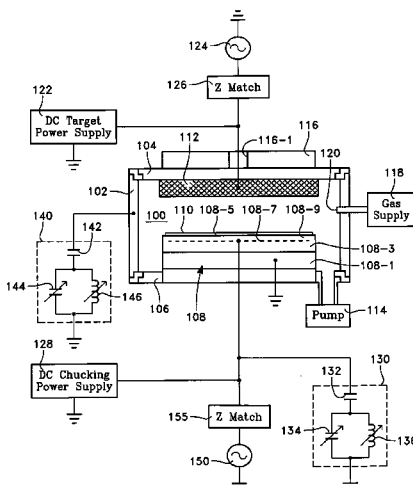
(51) **Int. Cl.**
C23C 14/34 (2006.01)
C23C 14/35 (2006.01)
 (Continued)

In a plasma enhanced physical vapor deposition of a material onto workpiece, a metal target faces the workpiece across a target-to-workpiece gap less than a diameter of the workpiece. A carrier gas is introduced into the chamber and gas pressure in the chamber is maintained above a threshold pressure at which mean free path is less than 5% of the gap. RF plasma source power from a VHF generator is applied to the target to generate a capacitively coupled plasma at the target, the VHF generator having a frequency exceeding 30 MHz. The plasma is extended across the gap to the workpiece by providing through the workpiece a first VHF ground return path at the frequency of the VHF generator.

(52) **U.S. Cl.**
 CPC **C23C 14/35** (2013.01); **C23C 14/3471** (2013.01); **C23C 14/50** (2013.01); **H01J 37/3266** (2013.01); **H01J 37/32091** (2013.01); **H01J 37/32174** (2013.01); **H01J 37/32577** (2013.01); **H01J 37/32706** (2013.01);
 (Continued)

(58) **Field of Classification Search**
 USPC 204/298.08, 298.12, 192.12, 192.15
 See application file for complete search history.

15 Claims, 5 Drawing Sheets



- (51) **Int. Cl.**
H01J 37/32 (2006.01)
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C23C 14/50 (2006.01)
- (52) **U.S. Cl.**
CPC *H01J 37/32715* (2013.01); *H01J 37/34*
(2013.01); *H01J 37/3444* (2013.01)

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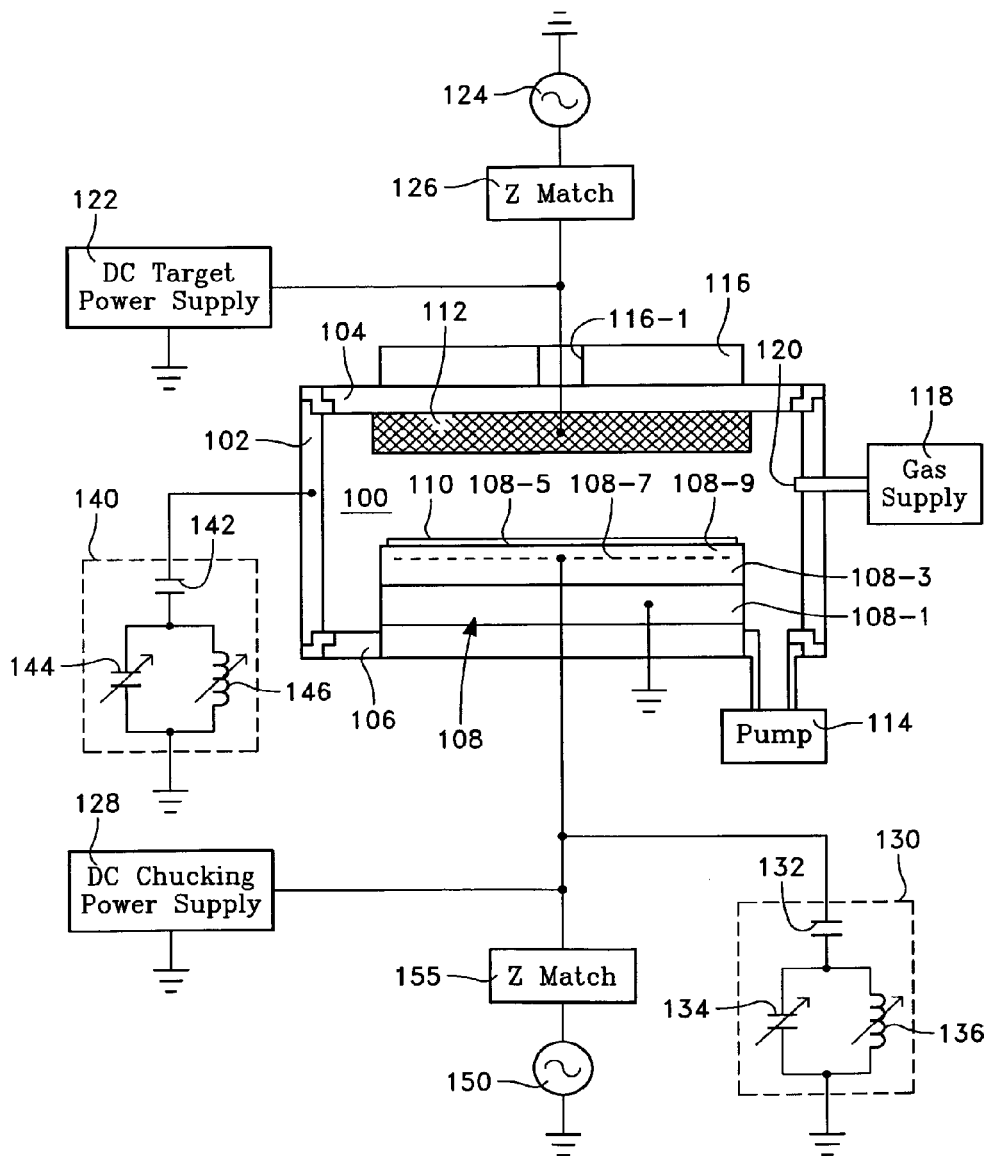


FIG. 1

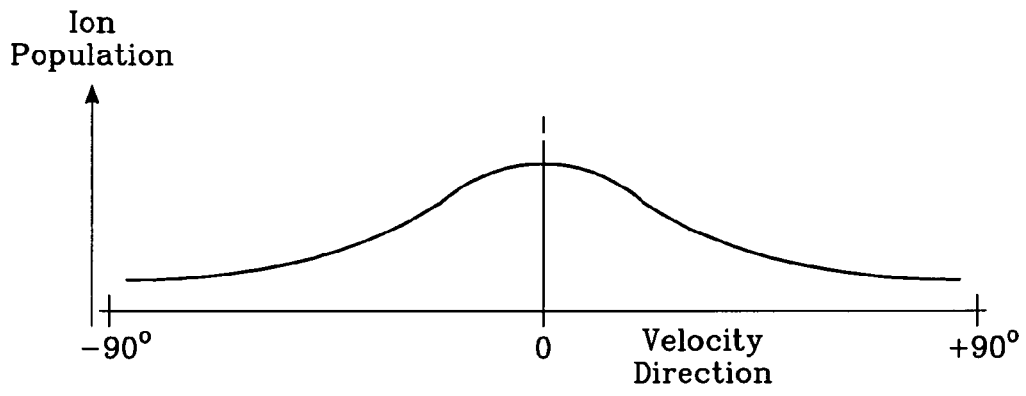


FIG. 2

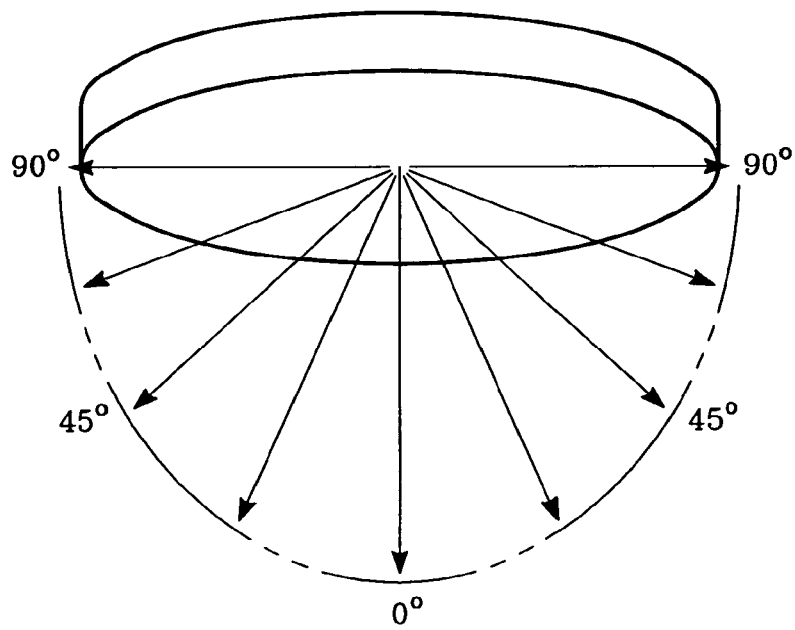


FIG. 3

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