



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

(10) **Patent No.:** **US 9,410,247 B2**  
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **CHEMICAL VAPOR DEPOSITION APPARATUS**  
(71) Applicant: **Samsung Electronics Co., Ltd.**,  
Suwon-si, Gyeonggi-do (KR)  
(72) Inventors: **Jong Hyun Lee**, Seoul (KR); **Hyun Seok Ryu**, Gyeonggi-do (KR); **Jung Hyun Lee**, Gyeonggi-do (KR); **Ki Sung Kim**, Gyeonggi-do (KR); **Suk Ho Yoon**, Seoul (KR); **Young Sun Kim**, Gyeonggi-do (KR)  
(73) Assignee: **SAMSUNG ELECTRONICS CO., LTD.** (KR)

(58) **Field of Classification Search**  
CPC ..... C23C 16/45565; C23C 16/45578; C23C 16/4583; C23C 16/4558; H01L 21/0254; H01L 21/0262; H01L 21/02573  
USPC ..... 118/715; 156/345.33  
See application file for complete search history.

(56) **References Cited**  
U.S. PATENT DOCUMENTS  
4,664,747 A \* 5/1987 Sekiguchi ..... H01L 21/3185 118/50.1  
4,989,540 A \* 2/1991 Fuse ..... C23C 16/4405 118/715

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 542 days.

(Continued)  
FOREIGN PATENT DOCUMENTS  
JP 09055372 A \* 2/1997  
KR 1020020092119 A 12/2002

(21) Appl. No.: **13/655,696**  
(22) Filed: **Oct. 19, 2012**

(Continued)  
*Primary Examiner* — Rudy Zervigon  
(74) *Attorney, Agent, or Firm* — Renaissance IP Law Group LLP

(65) **Prior Publication Data**  
US 2013/0098293 A1 Apr. 25, 2013

(57) **ABSTRACT**

(30) **Foreign Application Priority Data**  
Oct. 20, 2011 (KR) ..... 10-2011-0107485

A chemical vapor deposition apparatus can include a reaction chamber having a reaction space therein; a wafer boat disposed in the reaction space, the wafer boat arranged and structured to support a plurality of wafers; and a gas supplying part disposed in the reaction chamber to supply two or more reaction gases to the plurality of wafers. The gas supplying part can include a plurality of gas pipes disposed in the reaction chamber to supply the two or more reaction gases from outside to the reaction space; and a plurality of supplying pipes disposed around the wafer boat, wherein each of the supplying pipes is connected to two or more corresponding gas pipes, and wherein each supplying pipe is configured to supply the two or more reaction gases supplied by the two or more corresponding gas pipes to a corresponding one of the wafers.

(51) **Int. Cl.**  
**C23C 16/455** (2006.01)  
**C23C 16/458** (2006.01)  
**H01L 21/02** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **C23C 16/45565** (2013.01); **C23C 16/4558** (2013.01); **C23C 16/4583** (2013.01); **C23C 16/45578** (2013.01); **H01L 21/0254** (2013.01); **H01L 21/0262** (2013.01); **H01L 21/02573** (2013.01)

**18 Claims, 6 Drawing Sheets**

