

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

(10) **Patent No.:** **US 9,410,244 B2**  
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **SEMICONDUCTOR PROCESSING APPARATUS INCLUDING A PLURALITY OF REACTORS, AND METHOD FOR PROVIDING THE SAME WITH PROCESS GAS**

(75) Inventors: **Theodorus G. M. Oosterlaken**, Almere (NL); **Radko Bankras**, Almere (NL)

(73) Assignee: **ASM IP HOLDING B.V.**, Almere (NL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 825 days.

(21) Appl. No.: **13/602,713**

(22) Filed: **Sep. 4, 2012**

(65) **Prior Publication Data**

US 2014/0060430 A1 Mar. 6, 2014

(51) **Int. Cl.**  
**C23C 16/455** (2006.01)  
**C23C 16/44** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **C23C 16/44** (2013.01); **C23C 16/45525** (2013.01); **C23C 16/45561** (2013.01); **Y10T 137/0318** (2015.04); **Y10T 137/85938** (2015.04)

(58) **Field of Classification Search**  
CPC ..... C23C 16/45512  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,843,882 B2 \* 1/2005 Janakiraman ..... C23C 16/4412 118/715  
2006/0062900 A1 \* 3/2006 Selvamanickam .... C23C 16/408 427/62  
2006/0090702 A1 \* 5/2006 Koo et al. .... 118/719  
\* cited by examiner

*Primary Examiner* — Parviz Hassanzadeh  
*Assistant Examiner* — Nathan K Ford  
(74) *Attorney, Agent, or Firm* — Preti Flaherty Beliveau & Pachios LLP

(57) **ABSTRACT**

A semiconductor processing apparatus is described. The semiconductor processing apparatus includes a gas supply system. The gas supply system has at least one gas supply unit including a process gas source, a gas distribution manifold having an annular gas distribution conduit provided with an inlet and valved outlets; and a gas supply conduit fluidly connecting the process gas source to the inlet of the gas distribution manifold. The semiconductor processing apparatus also includes a plurality of reactors, each fluidly connected to a respective valved outlet of the gas distribution manifold, such that process gas from the process gas source of the at least one gas supply unit is selectively supplyable to a respective reactor via the gas supply conduit, the gas distribution manifold, and a respective valved outlet. A method of providing a plurality of reactors with process gas is also described.

**14 Claims, 5 Drawing Sheets**

