



## TECHNOLOGY

# Segmented Reactor Showerhead Design with Exhaust Gas Recirculation and Spatially-Resolved Sensing Capability for Chemical Vapor Deposition, Plasma-Enhanced CVD, and Plasma Etch Processes

## OVERVIEW

Chemical vapor deposition (CVD) is a process for depositing thin films from reactive gaseous chemical species onto a substrate in a controlled reactor environment for semiconductor and other materials manufacturing applications. In some instances, plasmas are used to enhance the deposition rate of desired materials. With manufacturing trends demanding increasing substrate (e.g., silicon wafers) sizes, the challenge of maintaining across-wafer film property uniformity likewise increases. Showerhead-type reactant delivery devices, sometimes positioned in close proximity to the wafer surface, are used in single-wafer processes in attempts to achieve uniform deposition and wafer-to-wafer quality repeatability.

Most conventional CVD systems do not have the spatial actuation and sensing capabilities necessary to control film uniformity or to intentionally induce non-uniform deposition patterns for single wafer combinatorial CVD experiments. To address these limitations, inventors at the University of Maryland, College Park, have built a multi-zone programmable CVD showerhead that generates highly controlled deposition conditions across the wafer, allowing a number of novel operating modes in single wafer processing and providing excellent quality control from wafer to wafer. The multi-zone showerhead features a reverse-flow design to improve gas composition spatial control; gas flow rates and compositions in each segment are independently controlled allowing the reactor system configuration to be reprogrammed completely within software. The device includes the capability to perform spatially resolved gas composition sampling for real time film quality control. In addition to CVD, plasma enhanced CVD and etch capabilities, applications of the programmable reactor design to combinatorial materials and process discovery and atomic layer deposition (ALD) processes are in development.

See U.S. patent 6,821,910

For more information please contact the University of Maryland, Office of Technology Commercialization. 301 405-3947 or by e-mail at [otc@umd.edu](mailto:otc@umd.edu).

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## **Additional Information**

### **INSTITUTION**

University of Maryland, College Park

### **CATEGORIES**

- Chemical

### **EXTERNAL RESOURCES**

- [US Patent 6,821,910](#)

PS-2000-029