

US005786276A

# United States Patent [19]

[11] Patent Number: **5,786,276**

Brooks et al.

[45] Date of Patent: **Jul. 28, 1998**

[54] **SELECTIVE PLASMA ETCHING OF SILICON NITRIDE IN PRESENCE OF SILICON OR SILICON OXIDES USING MIXTURE OF CH<sub>3</sub>F OR CH<sub>2</sub>F<sub>2</sub> AND CF<sub>4</sub> AND O<sub>2</sub>**

|           |        |               |         |
|-----------|--------|---------------|---------|
| 4,654,114 | 3/1987 | Kadomura      | 156/643 |
| 5,201,994 | 4/1993 | Nonaka et al. | 156/643 |
| 5,318,668 | 6/1994 | Tamaki et al. | 156/662 |

### FOREIGN PATENT DOCUMENTS

60-115231 6/1985 Japan

[75] Inventors: **Cynthia B. Brooks**, Sunnyvale; **Walter Merry**, Cupertino; **Ajey M. Joshi**, San Jose; **Gladys D. Quinones**, Santa Clara; **Jitske Trevor**, Sunnyvale, all of Calif.

*Primary Examiner*—R. Bruce Breneman  
*Assistant Examiner*—George Goudreau  
*Attorney, Agent, or Firm*—Fliesler, Dubb. Meyer & Lovejoy

[73] Assignee: **Applied Materials, Inc.**, Santa Clara, Calif.

### [57] ABSTRACT

[21] Appl. No.: **829,683**

A chemical downstream etching (CDE) that is selective to silicon nitrides (SiN) over silicon oxides (SiO) uses at least one of a CH<sub>3</sub>F/CF<sub>4</sub>/O<sub>2</sub> recipe and a CH<sub>2</sub>F<sub>2</sub>/CF<sub>4</sub>/O<sub>2</sub> recipe. Inflow rates are mapped for the respective components of the input recipe to find settings that provide both high nitride etch rates and high selectivity towards the SiN material. A pins-up scheme is used for simultaneously stripping away backside nitride with topside nitride.

[22] Filed: **Mar. 31, 1997**

[51] Int. Cl.<sup>6</sup> ..... **B44C 1/22; H01L 21/302**

[52] U.S. Cl. .... **438/724; 438/719; 438/723; 438/740**

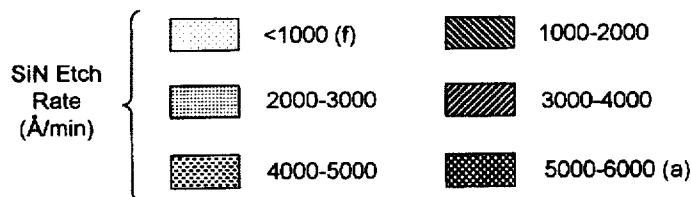
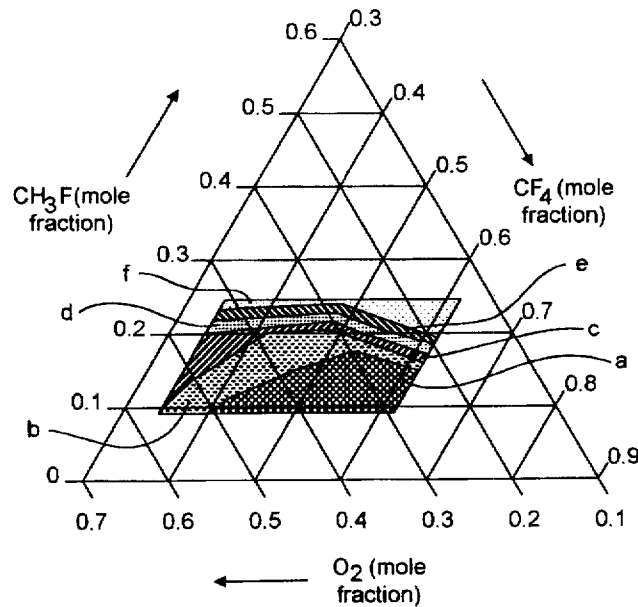
[58] Field of Search ..... 438/724, 719, 438/723, 740

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,529,476 7/1985 Kawamoto et al. .... 156/643

**18 Claims, 6 Drawing Sheets**



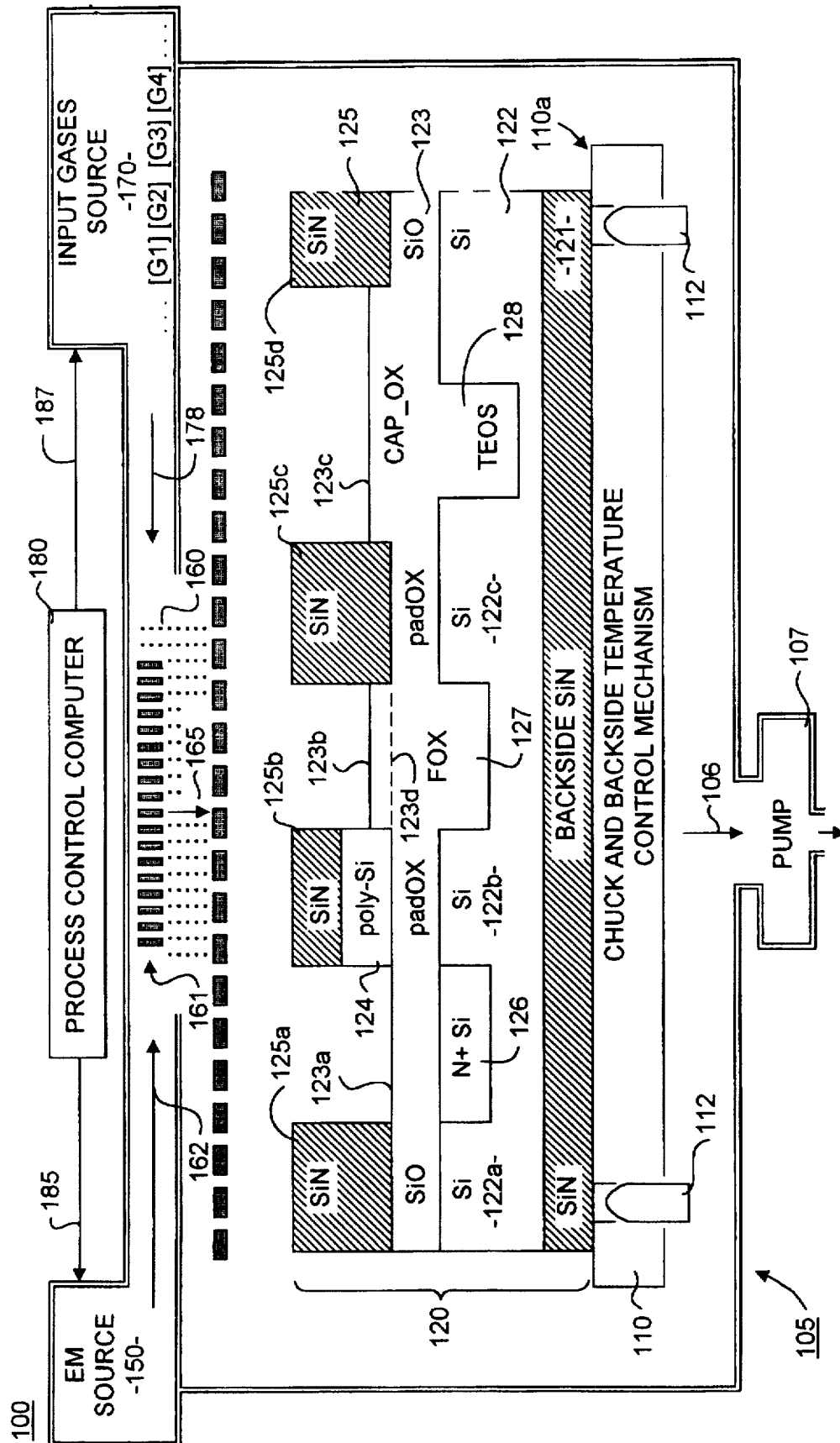


FIG. 1

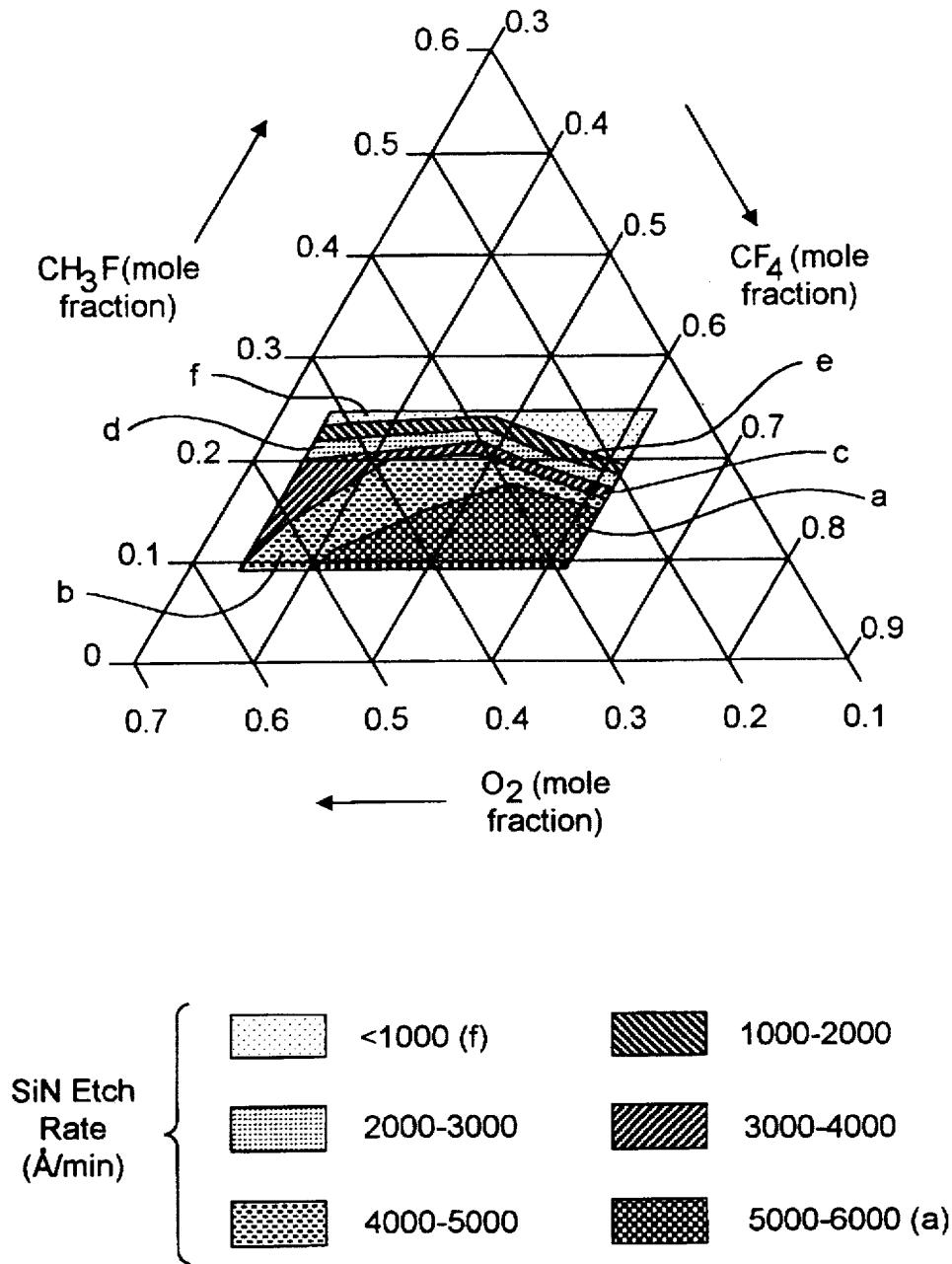


FIG. 2

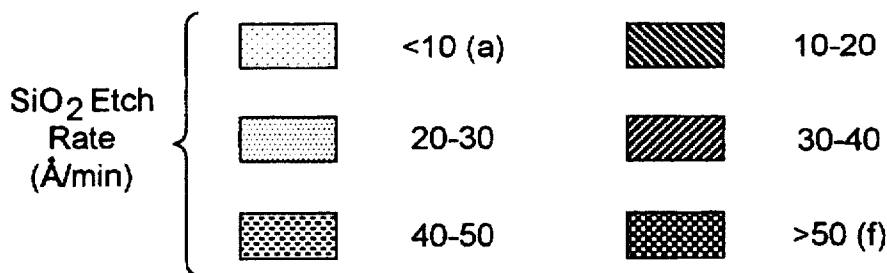
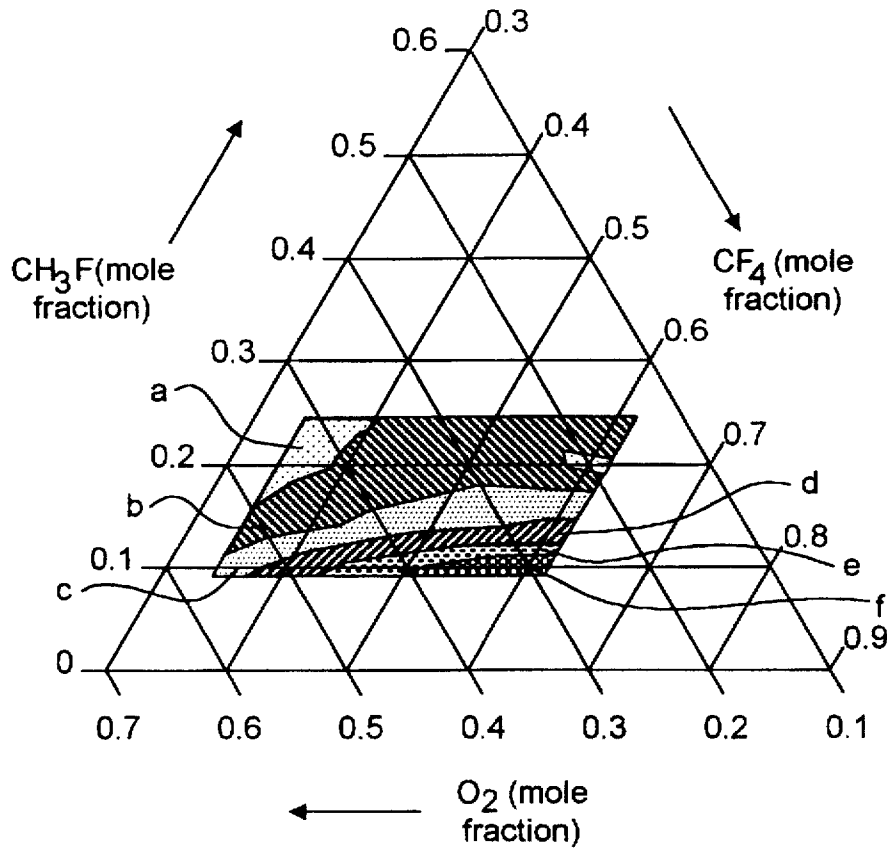


FIG. 3

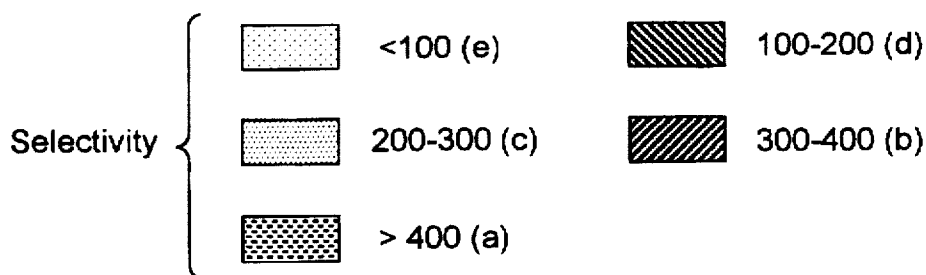
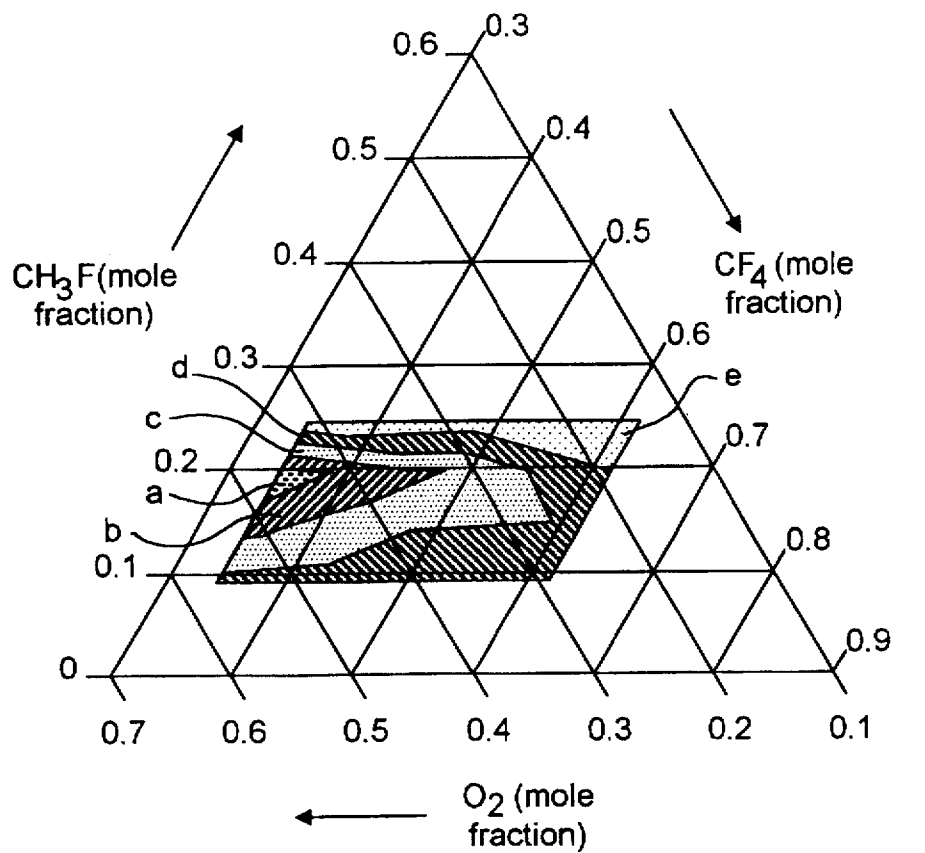


FIG. 4

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.