

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
13 February 2003 (13.02.2003)

PCT

(10) International Publication Number  
**WO 03/012162 A1**

(51) International Patent Classification<sup>7</sup>: **C23C 16/44**,  
16/458, C25F 3/04

Winchester Boulevard, #5, Santa Clara, CA 95050 (US).  
**THACH, Senh**; 32257 Jean Drive, Union City, CA 94587 (US).

(21) International Application Number: PCT/US02/23287

(22) International Filing Date: 22 July 2002 (22.07.2002)

(74) Agents: **BERNADICOU, Michael, A.** et al.; Blakely, Sokoloff, Taylor & Zafman LLP, 12400 Wilshire Boulevard, 7th floor, Los Angeles, CA 90025 (US).

(25) Filing Language: English

(81) Designated States (*national*): CN, JP, KR, SG.

(26) Publication Language: English

(84) Designated States (*regional*): European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR).

(30) Priority Data:  
09/918,683 27 July 2001 (27.07.2001) US

**Published:**  
— with international search report

(71) Applicant: **APPLIED MATERIALS, INC.** [US/US];  
P.O. Box 450A, Santa Clara, CA 94052 (US).

(72) Inventors: **SUN, Jennifer, Y.**; 9964 Alpine Terrace,  
Sunnyvale, CA 94086 (US). **STOW, Clifford, C.**; 480 N.

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: ELECTROCHEMICALLY ROUGHENED ALUMINUM SEMICONDUCTOR PROCESSING APPARATUS SURFACES

(57) Abstract: A uniform, controllable method for electrochemically roughening an aluminum-comprising surface to be used in a semiconductor processing apparatus is disclosed. Typically the aluminum-comprising surface is aluminum or an aluminum alloy. The method involves immersing an aluminum-comprising surface in an HCl solution having a concentration ranging from about 1 volume % to about 5 volume %, at a temperature within the range of about 45 °C to about 80 °C, then applying an electrical charge having a charge density ranging from about 80 amps/ft.<sup>2</sup> to about 250 amps/ft.<sup>2</sup> for a time period ranging from about 4 minutes to about 25 minutes. A chelating agent may be added to enhance the roughening process. The electrochemical roughening method can be used on aluminum alloys in general, including but not limited to 6061 and LP. The electrochemical roughening provides a smoothly rolling surface which does not entrap particles and which provides increased surface area for semiconductor process byproduct adhesion. The roughened surface provides an excellent surface for subsequent anodization.



WO 03/012162 A1