Marc Heyns (editor)
Marc Meuris & Paul Mertens (co-editors)

Proceedings of the Second International Symposium on Ultra-clean Processing of Silicon Surfaces

acco

INTEL 1015



Marc Heyns (editor)
Marc Meuris & Paul Mertens (co-editors)

Proceedings of the Second International Symposium on

Ultra-Clean Processing of Silicon Surfaces (UCPSS '94)

Acco Leuven / Amersfoort



Conference organized by IMEC

First Edition: 1994

TW. 250.00.0 32 012 3262

Published by Uitgeverij Acco, Tiensestraat 134-136, 3000 Leuven (België)
For the Netherlands: Postbus 1285, 3800 BG Amersfoort / Hamersveldseweg 10a, 3833 GP Leusden

© 1994 by Acco (Academische Coöperatief c.v.), Leuven, (België)

No part of this book may be reproduced in any form, by mimeograph, film or any other means without permission in writing from the publisher.

D/1994/0543/216

NUGI 841

ISBN 90-334-3262-5



Table of Contents

Preface Marc Heyns	11
Trends in Wafer Cleaning Technology Takeshi Hattori Keynote Presentation	13
Recipes to Avoid Particle Contamination during Wet Cleaning Processes L. Mouche, B. Beneyton, C. Paillet, J.P. Joly, F. Tardif, D. Levy, K. Barla, P. Patruno, A. Tonti and W. Sievert	19
Summary of HF-Last Wet Processing Using Direct-Displacement	23
Technology G.N. DiBello, S.T. Bay, C.F. McConnell, J.W. Parker and E.A. Cheney	
The Impact of Integrated Pre-cleans on Gate Oxide Integrity S. O'Brien, G. Brown and C. Tipton	27
Marangoni Drying: a New Concept for Drying Silicon Wafers R. Schild, K. Locke, M. Kozak and M.M. Heyns	31
Particle Removal Efficiency from Native Oxides Using Dilute SC-1 Megasonic Cleaning S.L. Cohen, W. Syverson, S. Basiliere, M.J. Fleming, B. Furman, C. Gow, K. Pope, R. Tsai and M. Liehr	35
Metal Removal without Particle Addition: Optimization of the Dilute HCl Clean T.Q. Hurd, P.W. Mertens, L.H. Hall and M.M. Heyns	41
Diagnostics of Process-Hygiene in Large Scale Si-Manufacturing Using Trace-Analytical Tools L. Fabry, L. Köster, S. Pahlke, L. Kotz and J. Hage (Invited)	47
Ultra-Trace Metal Analysis of Si Wafer Surfaces Using Synchroton Radiation A. Fischer-Colbrie, S.S. Laderman, S. Brennan, N. Takaura, P. Pianetta, A. Shimazaki, K. Miyazaki, J. Kortright, D.C. Wherry	57
Quantitative Depth Analysis of Ultratrace Elements in Silicon Wafers M. Takenata, M. Hayashi, H. Matsunaga, Y. Honma, A. Kubota and Y. Matsushita	61
Characterisation of Oxides and Thin Films Using a Novel Scanning Kelvin Probe	65

TW. 250.00.0 32 012 3262

a, 3833 GP Leusden

any other means without

ISBN 90-334-3262-5



I.D. Baikie, G.H. Bruggink and S. Rival

Reoxidation Kinetics of HF-Etched Si(100), Si(110) and Si(111) Surfaces in Air J.T. Beechinor, P.V. Kelly, G.M. O'Connor and G.M. Crean	69
A Comparative Study of Measurements of Roughness of Silicon and SiO ₂ Surfaces and Interfaces Using Scanning Probe Microscopy, Neutron and X-Ray Reflectivity A. Crossley, C.J. Sofield, J. Goff, A.C.I. Lake, M.T. Hutchings, A. Menelle and M.P. Murrell	75
In situ Monitoring of the Effect of Oxygen and Hydrogen Plasmas on the Passivation Level of Silicon Surfaces H. Li, E.A. Ogryzlo and J.G. Cook	79
Effect of Dynamical Plasma Cleaning on Si-SiO ₂ Structures V.M. Maslovsky and G.Y. Pavlov	83
Adsorption and Desorption Studies of U-238 on Silicon Surfaces G. Mainka, S. Metz, A. Fester, H. Ochs and B.O. Kolbesen	87
A UHV Compatible Plasma Chemical Cleaning Procedure for Low Temperature Epitaxial Growth on Patterned Silicon Substrates E. Beck, A. Dommann, I. Eisele, W. Hansch, N. Korner, D. Krüger and J. Ramm	91
Soft Cleaning by in Vacuo Ultraviolet Radiation before MBE G. Lippert and H.J. Osten	95
The Effect of Various Processing and Hardware Parameters on the Decomposition of H_2O_2 in APM A. Philipossian and R. Wilkinson	99
SCA Determination of Charges in Oxide after Metallic Contamination K. Barla, F. Tardif, D. Walz and C. d'Assenza	103
Calibration of TXRF Equipment J. Knoth, H. Schwenke and P. Eichinger	107
Transfer Behavior of Metallic Contaminants from Solutions to Wafers U. Keller, W. Aderhold and E.P. Burte	111
Low Temperature Oxides Deposited by Remote Plasma Enhanced CVD LÅ. Ragnarsson, S. Bengtsson, M.O. Andersson and U. Södervall	117
H ₂ O Microcontamination Generated by Reaction between Anhydrous HBr Gas and Transition Metal Oxides A. Boireau, H. Chevrel, N. Uchida, K. Miyazaki, E. Ozawa and J.M. Friedt	121
U.V. Activated Cleaning Using NO, HCl and NO/HCl C. Elsmore, R. Gluck, P. Carr, M. Meuris, P.W. Mertens and M.M. Heyns	125



DOCKET

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.

