Study of the roughness in a photoresist masked, isotropic, SF6-based ICP silicon etch - DTU Orbit (05/10/2019)

Study of the roughness in a photoresist masked, isotropic, SF6-based ICP silicon etch

In this paper we study the etching behavior and the resulting roughness in photoresist-masked isotropic silicon plasma etch performed in an inductively coupled plasma (ICP) etcher using SF6. We report detailed observations of the resulting roughness for various etching parameters, covering: pressure from 2.5 to 70 mTorr, SF6 flow rate from 50 to 300 sccm, platen power from 0 to 16 W, and ICP power from 1000 to 3000 W. Etch processes with a normalized roughness below 0.005 were found at low pressure, p = 10 mTorr, while larger normalized roughness, above 0.02, occurred at higher pressures, p = 40 - 70 mTorr. Here the normalized roughness is the ratio of the roughness amplitude to the etch depth. The rough etching processes showed characteristic high-aspect-ratio and crystal-orientation-dependent surface morphology. The temporal evolution of this roughness was studied, and observations suggest a gradual buildup of surface contamination (redeposits) originating from the photoresist mask. A model was used to analyze the etched profiles with respect the internal etching conditions. The almost isotropic etching profiles, obtained in both rough and smooth etching processes, are generally highly radical-dependent; however, the surface roughness itself can be reduced dramatically using an ion energy above a certain threshold value. The roughness causing mechanism is discussed. (c) 2006 The Electrochemical Society.

General information
Publication status: Published
Organisations: Department of Micro- and Nanotechnology, Silicon Microtechnology Group, MicroElectroMechanical Systems Section, Center for Individual Nanoparticle Functionality
Contributors: Larsen, K. P., Petersen, D. H., Hansen, O.
Pages: G1051-G1058
Publication date: 2006
Peer-reviewed: Yes

Publication information
Journal: Journal of The Electrochemical Society
Volume: 153
Issue number: 12
ISSN (Print): 0013-4651
Ratings:
Scopus rating (2006): SJR 1.608 SNIP 1.522
Web of Science (2006): Indexed yes
Original language: English
Electronic versions:
Dirch.pdf
DOI:
10.1149/1.2357723
URLs:
http://dx.doi.org/10.1149/1.2357723

Bibliographical note
Copyright The Electrochemical Society, Inc. [2006]. All rights reserved. Except as provided under U.S. copyright law, this work may not be reproduced, resold, distributed, or modified without the express permission of The Electrochemical Society (ECS).
Source: orbit
Source ID: 193903
Research output: Contribution to journal › Journal article – Annual report year: 2006 › Research › peer-review