Sensors and Materials, Vol. 15, No. 2 (2003) 093–099
MYU Tokyo

S & M 0512

Difference in Activated Atomic Steps on (111) Silicon Surface during KOH and TMAH Etching

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(Received October 11, 2002; accepted April 2, 2003)

Key words: anisotripic etching, silicon, KOH, TMAH, atomic step

Anisotropic etching of (111) silicon surface using potassium hydroxide (KOH) and tetra-methyl ammonium hydroxide (TMAH) solutions was experimentally investigated. Etching advanced as a result of lateral movement of steps of 20–50 nm in height. Steps on the (111) surface are classified into two groups, those that are perpendicular to $[11\bar{2}]$ and, those that are perpendicular to $[\bar{1}\bar{1}2]$. Steps having a three-backbonded edge were more stable than those having a two-backbonded edge in case of KOH etching. On the contrary, in case of TMAH, steps having a three-backbonded edge were more active than steps having a two-backbonded edge. This fact explains the difference in macroscopic anisotropy in KOH and TMAH etching in the vicinity of (111).