Abstract Submitted for the MAR05 Meeting of The American Physical Society

The Step Bunching Instability during Aqueous Silicon Etching HAILING BAO, SIMON GARCIA, MELISSA HINES, Dept. of Chemistry, Cornell University, Ithaca, NY 14853 — STM investigations of vicinal Si(111) surfaces etched in aqueous KOH solutions under controlled flow conditions show that macrostep formation (step bunching) is driven by inhomogeneities that develop in the etchant (not on the surface) as a result of the highly step-site-specific etching reactions. Using a microfabricated test pattern, we confirm that aqueous silicon etching is inherently non-local. Micron-scale inhomogeneities develop in the etchant, and these inhomogeneities lead to a step bunching instability. A kinetic Monte Carlo simulation of this process, which combines an atomistic description of the etching surface with a coarse-grained model of etchant inhomogeneities, is in qualitative agreement with the experimental findings. The position and orientation of the bunches can be controlled using microfabricated etch barriers. This technique allows the creation of large, nearly atomically flat regions even on severely miscut surfaces.

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Date submitted: 22 Nov 2004

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