Enhanced Cleaning Chemistry for Particle Removal and Damage-free Cleans

Jianjun Hao*, William Wojtczak, Mark Stasney, Bill Bowers, Russell Stevens, Sian Collins, Laura Robichaux, Robert Reiter, Mark Hellums, Kelly Hefner, Richard Goodin
SACHEM Inc., Austin, Texas 78749, USA

Modern integrated circuit (IC) fabrication has widely employed SC-1 cleans and dilute NH4OH solutions to remove contaminant particles in Front End of the Line (FEOL) processing. As semiconductor device geometry continues to shrink, the size of "killer" particles also decreases to the nanoscale region. Thus, the damage free cleaning method for nanoscale particle removal will become more critical for future device yield. Unfortunately, currently existing cleaning methods are not qualified for such tasks. To solve this problem, new approaches must be investigated for the next generation cleaning formulations in order to (1) enhance zeta potential to achieve nanoscale particle removal and (2) decrease the etching of silicon dioxide or silicon surface to realize the damage free clean.

This work identifies and establishes an effective nanoparticle removal technique in an innovative cleaning chemistry for semiconductor wafer processing. The study provides an understanding of the basic removal mechanism, verified by experimental measurements. An effective, modified SC-1 cleaning chemistry, based on this fundamental understanding, has been developed.

*To whom all correspondence should be addressed. Tel: 512-912-4409; Fax: 512-892-3971; email: fhao@sacheminc.com

Dr. Jianjun Hao is a principal investigator of electronic chemical R&D in SACHEM Inc. Before his joining SACHEM, he worked with Dr. C. Grant Willson in UT Austin and engaged in the nanoimprinting lithography for dual damascene interconnection.