

Investigation of Interaction Forces between Contaminant Particle and the Wafer Surface in Post-CMP Cleaning

Lukasz Hupka, Jakub Nalaskowski and Jan D. Miller

Department of Metallurgical Engineering
412 WBB, University of Utah
Salt Lake City, UT 84112
Tel. 801-5816814
Fax. 801-5814937
Lukasz.Hupka@mines.utah.edu

Abstract

Interfacial interaction forces and adhesion between particulate contaminant and the surface play a key role in the understanding of post-CMP and post-lapping cleaning processes. In order to facilitate removal and prevent re-deposition of submicron particles on the surface understanding and regulation of these forces is required.

As the wafer structures become smaller and more fragile, it is crucial to confront the impact of different manufacturing steps, including the process of cleaning, with the strength of wafer structures. The force required to remove a contaminant should be close to force that is damaging to a structure in order to maximize particle removal efficiency, but not higher than this force in order to avoid structure damage.

Atomic Force Microscopy (AFM) besides being an imaging tool proves to be an indispensable instrument to characterize interaction forces, lateral forces, and adhesion between micron and submicron contaminant particles and cleaned surfaces in air and liquid. Using the AFM colloidal probe technique interaction forces and adhesion can be measured between single particles of contaminant and the surface of interest. Influence of system variables, including type of surfactant (or other additive), pH, and ionic strength can be quantitatively measured and optimized at the fundamental level.

Redeposition of particulates from cleaning bath is also discussed. 30-40 nm alumina contaminant particles suspended in different cleaning solutions were collided with wafer surface using impinging jet cell and the amount of contaminant left after impinging was investigated using AFM. These results are correlated with interfacial forces measured between the particles and the surface.

To be presented at the 5th International Surface Cleaning Workshop
“Future and Current Challenges in Surface Cleaning”
November 12-14, 2007, Boston, MA