

Evaluation of New Megasonic System for Single Wafer Cleaning

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The single wafer type Megasonics consisting of a vertical nozzle dispensing sonically excited liquids is limited in its use for semiconductor manufacturing. At operating conditions required to clean particles, damage to device structures also occurs. The reasons for trade-off between cleaning efficiency and device damage were previously investigated by evaluation of the propagation mechanisms [1].

Therefore, a new Megasonic single wafer cleaning system (Fig 1) was evaluated. It consists of a horizontal wafer spinner and a horizontal quartz rod. Megasonic is transmitted from the transducer to the quartz rod through the cleaning solution to the silicon wafer [2]. Cleaning experiments with 0.5 μ m Al lines and trench features showed that the new Megasonic method has improved cleaning efficiency without damaging the device features, as compared with the conventional Megasonic system.

Two methods were used to characterize the system and understand the data: (a) visualization of the Megasonic transmission using the Schlieren Method and (b) simulation using the Finite Difference Time Domain (FDTD). The Schlieren Method [3] is based on deviation of index of refraction caused by Megasonics in water. Figure 2 shows two types of Megasonic propagation from the quartz rod. One is perpendicular to the length of the rod and the other one is oblique (or almost parallel) to the rod. The wave positions and directions are a function of the wavelength in the quartz rod and in the water. The existence and position of the standing waves was further verified with the FDTD [4] results shown in figure 3.

Further modifications of the Megasonic wave directionality may lead to further improved cleaning without device damage.

References [1] A. Tomozawa, et al.: gMegasonic Silicon Wafer Cleaning and Its Influence on LSI Devices, pp.235-240, Proceedings of Fifth International Symposium on UCPSS2000 [2] Y. Wu, et al.: gAcoustic Property Characterization of a Single Wafer Megasonic Cleaner, pp.360-366, Proceedings Vol.99-36 of

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Fig.1 A New Megasonic Single Wafer Cleaning System having a Horizontal Quartz Rod

Fig.2 Schlieren Image of Megasonics from Quartz Rod

Fig.3 Simulation Result of Megasonics from Quartz Rod