Wet Cleaning Technology – Implementation

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As pointed out in SN-16 two important considerations in wet cleaning technology are: chemical composition of cleaning solutions and the way those solutions are delivered to the wafer for the purpose of surface cleaning. In this Note the latter is considered.

Wafers can be subjected to cleaning solutions one at the time (single wafer cleaning) or in batches in which number of wafers depends on the wafer size (batch cleaning). As far as implementation of cleaning is concerned three distinct techniques include immersion, spray, and spin cleaning. The first, as the name indicates, involves immersion of wafers (or a wafer) in a cleaning bath (Fig.1). This method assures uniform exposure of both surfaces of the wafer to cleaning chemistries and is compatible with megasonic agitation which, generating powerful sonic waves propagating in the direction parallel to the wafer surface, increases efficiency of cleaning (particle removal in particular). It also allows precise control of temperature of the bath and assures uniform rinsing. A down side of this approach is that it requires significant amounts of chemicals and water. **Immersion cleaning** is implemented in wet benches which include several cleaning/rinsing tanks. Cassettes with wafers are moved in the desired sequences from tank to tank.

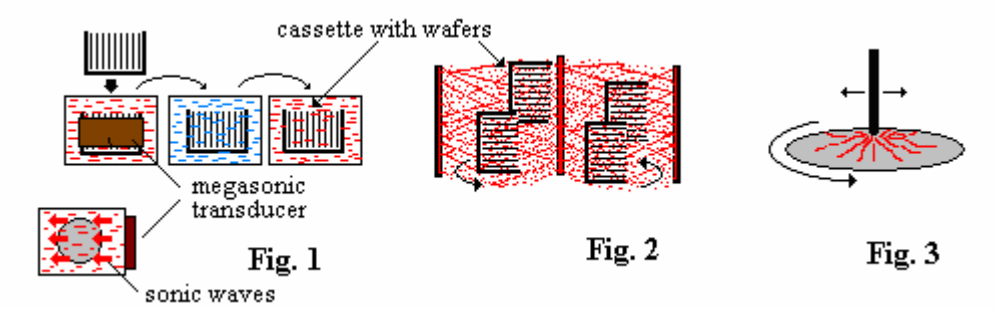

Fig. 1 Fig. 2 Fig. 3

In an alternative approach, known as **centrifugal spray cleaning**, cassettes with wafers are rotated in chemicals, or rinsing water, spray dispensed from the nozzles located in the in the center and on the outside walls of the process chamber (Fig. 2). This technique offers savings on chemicals and D.I. water, but its uniformity in select high-end applications may not be sufficient.

The third approach is a **spin cleaning** (Fig.3). Spin cleaning is a single-wafer process typically used in the case of large diameter wafers. In this technique chemicals or rinsing water are dispensed onto the rapidly rotated wafer. To increase efficiency a higher pressure spray, or "jet" spray, can be employed and the dispensing nozzle can be moved along the diameter of the rotating wafer.

The relative performance of each technique may vary from application to application and selection will be based on the balance between cost of chemicals and water and required performance in the context of the geometry of processed devices. In some applications wet cleans can be supplemented with gas-phase, or dry, cleaning methods (see SN-18) while in the others performance of the clean can be improved by using supercritical fluids (see SN-8). Each such modification brings about significant changes in the wafer cleaning infrastructure.