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Introduction of acoustic cavitation in semiconductor processing

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Surface preparation via wet processing is a critical step in semiconductor processing and must be repeated many times. It covers typically chemical processes such as etching (partial and selective removal of dielectric or metal films), cleaning (removal of particulate, organic and metallic contamination), stripping (photoresist removal) or even thin film deposition. As a matter of fact, the wet chemical processing that was traditionally done in batch systems is now migrating towards single wafer processing tools, which means that the substrate is only covered with a 500-2000 micrometer thick process liquid film. The interest in single wafer wet processing is mainly driven by process advantages such as the isolation of front- and back side of the wafer, the lowering of cross-contamination... Furthermore, it also allows the introduction of various acoustic resonators on either front- or backside that may induce acoustic cavitation within the process liquid, which fills the gap between substrate and resonator. The presence of cavitation may support the transition from a pure chemical process towards a physically assisted chemical process that may lead to the further improvement of process efficiency, uniformity and selectivity and the reduction of process costs. In this presentation an overview of the different challenges in semiconductor processing will be given and the onset and controlling of acoustic cavitation or even acoustic streaming of different types of resonators will be discussed. To improve processes based on acoustic cavitation such as the removal of nanoparticulate contamination, several aspects of multi bubble systems and structures will be presented, in order to deliver a damage free and highly efficient cleaning step.