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### Cleaning of semiconductor substrates by controlled cavitation

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The continuing down scaling of device geometries in the semiconductor industry is driving the requirements for both process and contamination control. Historically, the physical and the chemical processes required for contamination control were evolutionarily scaled with device geometry. However, today's tailored wet-chemical cleaning approaches must strive to meet stringent requirements to assure a minimal material loss and no damage to extremely fragile structures. While chemical solutions exist for the control of molecular-organic and metallic ion contamination, the physico-chemical solutions for the removal of nanosized particulate contamination to critical diameters below 20 nm are still undetermined. Therefore, the potential and the limitations of megasonic cleaning, which is mainly based on cavitation, are carefully balanced and a detailed understanding of the ongoing physical mechanisms is necessary to maintain a stable window of operation. The relevant active mechanisms present in such a cavitation driven cleaning process, will depend in great part on the characteristics of the applied sound field; that is to say on frequency, amplitude and uniformity and also on the properties of the cleaning liquid, i.e. the level of gasification, temperature, surface tension, and many others. Different techniques in conjunction with simulations and modeling are under development to improve the design of a novel cleaning tool that can address the challenges.