

Surface contaminants encountered in microelectronics manufacturing can be considered in terms of those added to the surface during wafer processing and those added during wafer storage. The latter concerns contaminants from the storage and shipping ambient including clean room air, containers, boxes, and cassettes. Assuming storage is taking place in a particle-free environment the contaminants originating from storage include primarily organic compounds and moisture.

Hence, these two are key contributors to the surface “aging” process which may interfere with subsequent processes or measurements such as ellipsometric measurements. In reality what is being considered to be a “clean” surface may actually look like a surface in Fig.1 which shows moisture and organic contaminants adsorbed on the hydrophilic silicon surface.

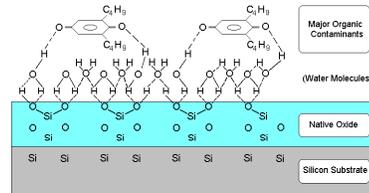


Fig.1[1]

Surface as shown in Fig. 1 features uncontrolled, irreproducible characteristics and as such cannot be further processed or measured without reversing of the “aging” process, or in other words without “refreshing” and stabilizing its condition. The common solution to the problem of surface deposits accumulated during wafer shipment and storage is a conventional wet surface cleaning. However, recent experimental efforts show that this time and resources consuming routine can in many applications be replaced with a brief illumination of silicon surface with heat generating lamps in an ambient air. Exposure as short as 30 seconds at the temperature not exceeding 300 °C is sufficient to remove light organics from the silicon surface. In Fig. 2 this effect is represented by the reduction of the surface contact angle (wetting angle) as a function of time of

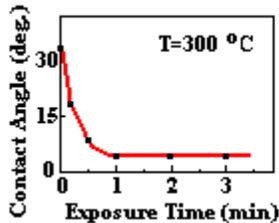


Fig. 2 [2]

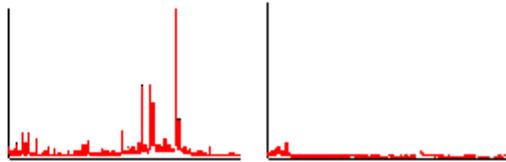


Fig. 3 [3]

lamp exposure at 300 °C. The same effect is demonstrated in Fig. 3 which shows outline of GC-MS spectra before (left) and after (right) lamp cleaning. Almost complete elimination of organic contaminants is represented by the reduction of red peaks in the spectrum following lamp exposure. The process is less effective when the surface is exposed to the clean room air for the extended period of time when less volatile organic compounds are formed [2]. On the other hand, lamp cleaning is very effective in the elimination of organic contaminants resulting from the IPA drying process.

Overall, the lamp cleaning, which is also referred to a Rapid Thermal Cleaning (RTC) offers cost and time saving solution to an important task of surface refreshing.

[1] T. Hattori et. al., e.g.: *J. Electrochem. Soc.*, 143, 3279 (1996).

[2] C-L. Tsai et al., *J. Electrochem. Soc.*, 150, G39 (2003).

[3] A. Danel et al., Proc. UVPSS V, *Solid St. Phenomena*, Vol. 92 (2003), p.195.