ITW Texwipe®

Progress in Pre-Wetted Wiper Cleanliness Levels

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Pre-wetted wipers have a time-honored reputation for simplifying the cleaning of critical surfaces within cleanrooms, e.g. environmental surfaces such as workstations and benchtops and tooling surfaces such as the interior of process chambers. Pre-wetted wipers replace the use of dry wipers with squirt bottles and offer a more convenient, cost-effective approach to contamination control. Companies using pre-wetted wipers have reported better protocol adherence (most likely due to the convenience factor), lower overall wiper usage, lower volatile organic compound (VOC) levels, reduced fire hazards and more reproducible wetting levels on wipers as compared to the use of dry wipers with squirt bottles.

Until recently, a known drawback associated with pre-wetted wipers was that when tested, they tended to exhibit particle levels higher than those for the corresponding dry wipers. The higher particle levels were linked to the long-term contact of the wetting agent with the wipers. It is interesting to note that users of pre-wetted wipers reported few if any contamination problems associated with this effect, commenting that critical surfaces cleaned with pre-wetted wipers were performing well. Likely, the pre-wetted wipers were contributing to cleaner surfaces overall and the elevated particle levels that were detectable on the pre-wetted wipers were not a source of additional contamination.

Since the higher particle levels found during the testing of pre-wetted wipers could potentially represent increased levels of particle exposure and risk to environmental surfaces and/or processes, ITW Texwipe embarked on a series of product improvements to reduce these particle levels. This has resulted in significantly lower releasable particles levels (especially in the 0.5 – 5 µm range) for pre-wetted wipers. While the specifics of the product improvements are proprietary we would like to share with you

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some test data that demonstrates the improved (lower) particle levels on pre-wetted wipers.

To understand the significance of the data, it is useful to briefly recap Test Method 15[4] used by ITW Texwipe for particle measurements. For this series of tests, pre-wetted wipers incorporating 100% isopropyl alcohol (IPA) as the wetting agent were prepared. After allowing the product to stand for a period of seven days, the package was opened, a pre-wetted wiper was removed and allowed to dry in a clean hood. The wiper was then immersed in a dilute surfactant solution contained in a photographic tray and orbitally shaken for five minutes to release particles and fibers to the solution. The liquid was then vacuum filtered through a submicron membrane filter to capture the released particles and fibers. The filter was examined by either optical microscopy (OM) and scanning electron microscopy (SEM) to count the particles and fibers. This test method has the advantage of direct measurement and enumeration of particles released from wipers, as opposed to liquid particle counting (LPC) methods. We have found that OM and SEM particle counting, as done in Test Method 15, can yield more consistent test results than LPC and can identify improvements in wiper manufacturing processes better than LPC. The particle release conditions described here may be considered as “worst case”; these levels of particles are unlikely to be experienced when pre-wetted wipers are used for contamination control activities in the cleanroom. Data reported here reflect the use of OM and SEM for counting particles and fibers.

Figures 1 through 3 below represent work done in the ITW Texwipe analytical laboratory. These figures show the particle and fiber results for unimproved pre-wetted product (leftmost bars), improved pre-wetted product (middle bars) and dry wiper product (rightmost bars). The figures represent the data for released small particles (0.5 – 5 µm), large particles (5 – 100 µm) and fibers (>100 µm), respectively. Note that the vertical axis in Figure 1 contains a 10^6 scaling factor; this factor is absent in Figures 2 and 3.

As can be seen for each particle range examined, the improved pre-wetted product exhibited lower particle and fiber values compared to the original unimproved product. For the small particles, the improvement is quite dramatic, a reduction of 7-fold, representing a decrease of 90 x 10^6 particles/m^2. The improved product approaches, but does not quite reach the particle and fiber values for dry wipers.

[4]Test Method 15: “Size Differentiated Counting of Particles and Fibers Released from Cleanroom Wipers Using Optical and Scanning Electron Microscopy”, 1998, ITW Texwipe, Mahwah, NJ USA. This method is equivalent to that used in ASTM E2090 and IEST RP4.3.

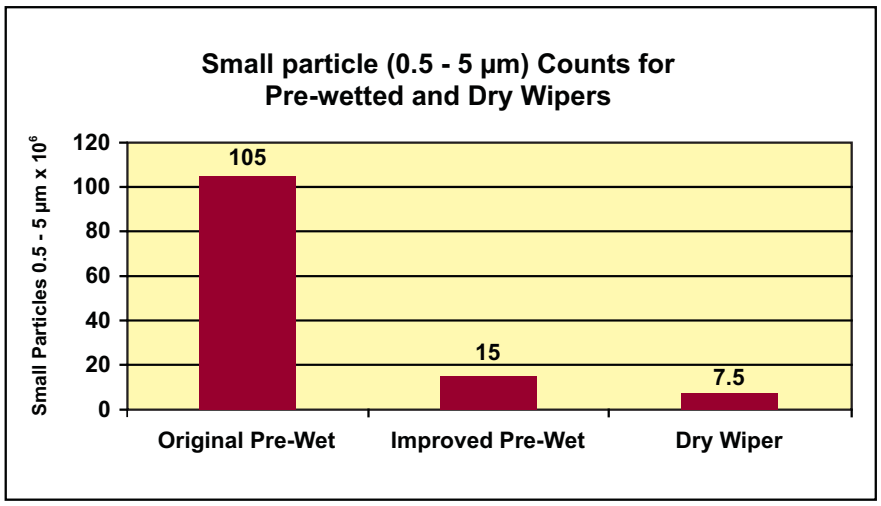

Figure 1

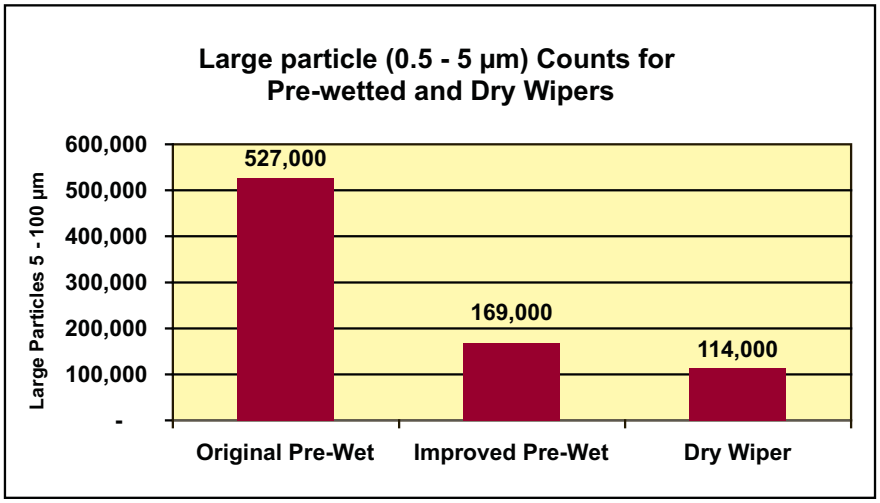

Figure 2

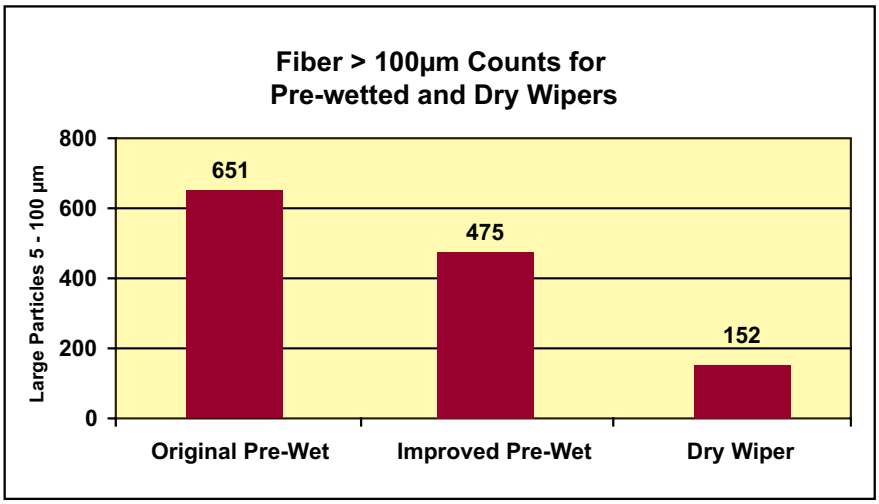

Figure 3

In a separate series of experiments — Figures 4 to 6 below — the particle and fiber levels of the improved ITW Texwipe pre-wetted wipers were measured against competitive pre-wetted wipers. Additionally, particle and fiber data for the corresponding dry wipers were compared. This set of measurements was done by a third-party laboratory, employing the same particle measurement techniques and experimental conditions as described above. In previous studies with this laboratory we have found that they typically report lower particle levels than the ITW Texwipe laboratory, probably due to differences in counting techniques. In each particle range examined, the improved ITW Texwipe pre-wetted wipers and dry wipers (blue bars) exhibited significantly lower values (in some cases orders of magnitude lower) than the corresponding competitive product (red bars), supporting our belief that the changes in our processing technology were producing measurable improvements. It must be noted that the manufacturing methods of the competitive wipers and the ITW Texwipe wipers are significantly different. The competitive wipers are laser-cut (i.e. the fibers are sealed only at the very edge of the wiper) and are batch laundered, leading to wiper-to-wiper interactions in the laundering process. By contrast, the ITW Texwipe wipers used in this study were border sealed (a 4 mm sealed surface at the perimeter of the wiper to minimize particle and fiber release) and laundered in an in-line configuration (Vectra® process), with no wiper-to-wiper interactions, to produce overall lower levels of particles and fibers.

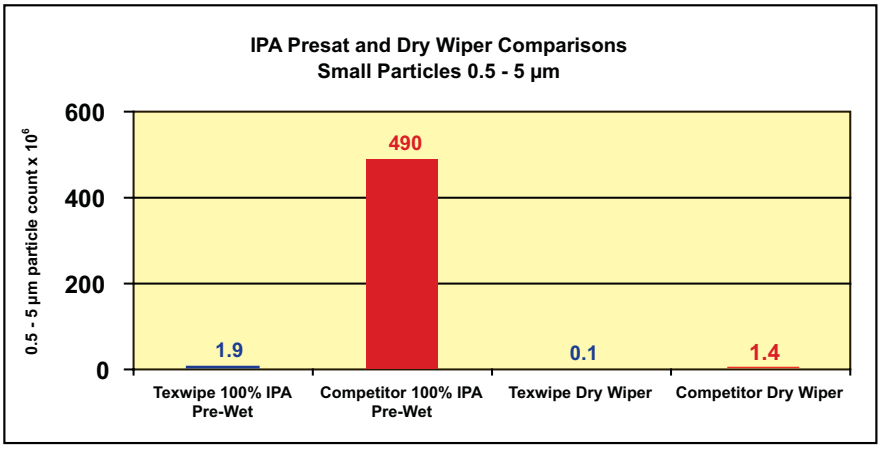

Figure 4

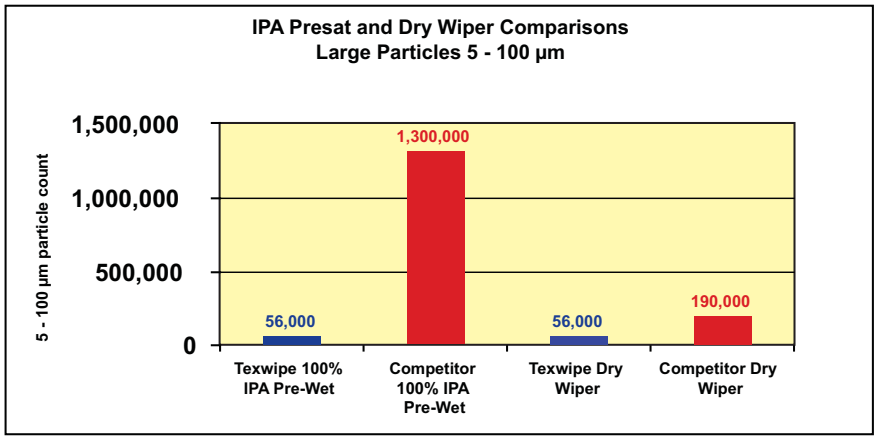

Figure 5

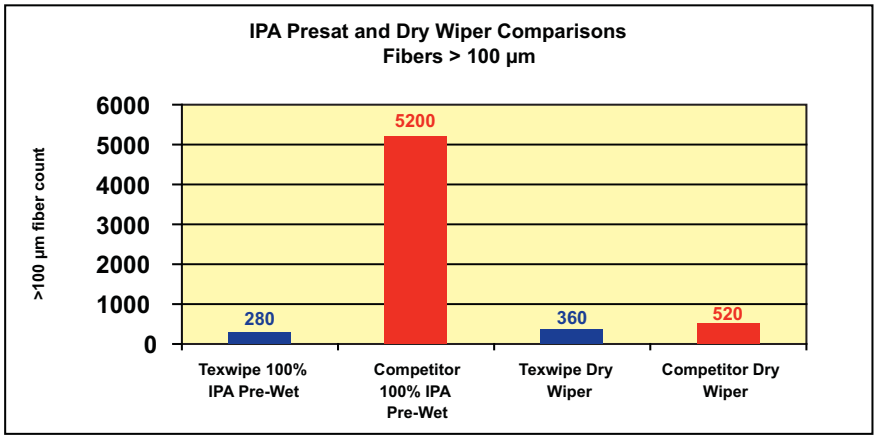

Figure 6

Conclusions

Improvements in wiper manufacturing technology have been demonstrated to produce lower levels of releasable particles and fibers in pre-wetted wipers.

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