

## Trace Metal Analysis of Cleanroom Dry Wipers by Inductively Coupled Plasma – Mass Spectrometry

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Cleanroom wipers are widely used in precision cleaning for critical environment and tool components; and in controlling contamination and minimizing its effect on critical manufacturing processes in semiconductor and many other industries. The cleanliness of these wipers has profound effect on the processes as well as the final products. Testing methods from standard organizations like IEST and wiper manufacturers are available for basis weight, nonvolatile residue, particles, among others. Trace metals have been tested with ionic species by ultrapure water and dilute acid extraction followed by ion chromatographic analysis.

In this work, three cleanroom dry wipers from different manufacturers are tested for trace metals by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) using three different sample preparation methods – ultrapure water extraction with ultra-sonication, acid extraction (both at room temperature), and high temperature ashing. The results showed that all three wipers have high level of Ti at 0.01 – 0.013 g/wiper or 0.15 - 0.18% of wiper weight. It can be seen that, even with sonication, trace metals extracted by ultrapure water were very limited.

This is probably due to the effective laundrying processes performed by the manufacturers before final product release. Dilute nitric acid extraction was much more effective to extract the trace metals from the wipers and the results were hundreds of times higher than the ultrapure water extraction. In this case, it is believed that, in addition to the particles attached to the fiber surface that would show in the ultrapure water extraction, many, but not all, particles embedded inside the fiber were extracted. Whether current extraction conditions reached the steady state remains unknown and further experiment has to be performed to determine the best extraction conditions. The high temperature ashing process released all metals, attached and embedded, so the metal results were the highest among all three methods used. When compared across the wipers tested, Wiper 2 showed highest metal levels in the ultrapure water extraction test, whereas Wiper 1 showed highest K level, Wiper 3 with highest Na and Ca in the acid extraction. The total metals obtained with the high temperature ashing method for the three wipers vary but the difference was not significant (Figure 3).

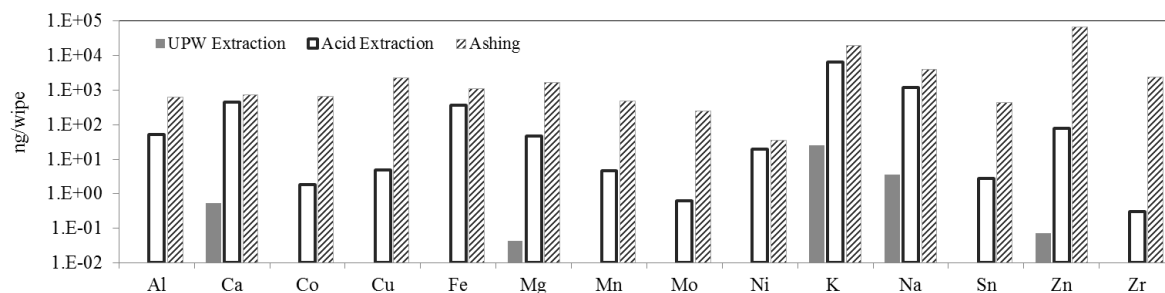


Figure 1. Trace metal results for Wiper 1 under different testing conditions

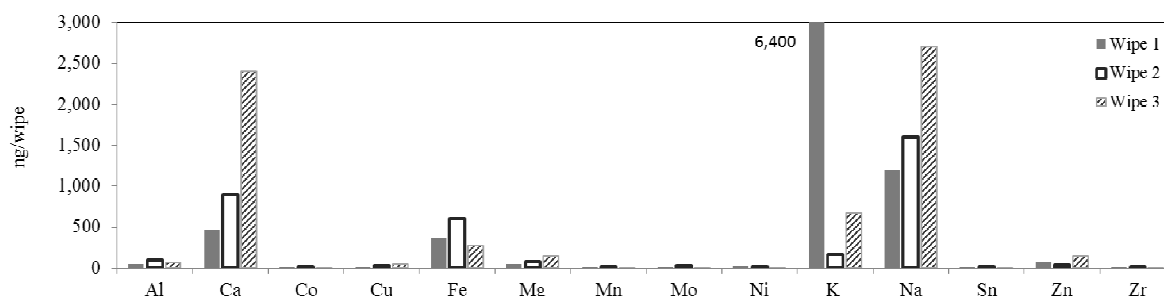


Figure 2. Trace metal results from acid extraction ICP-MS.

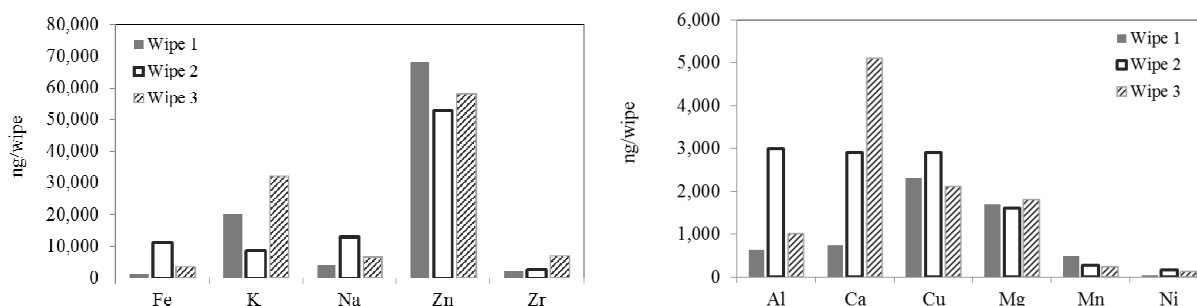


Figure 3. Trace metal results from high temperature ashing ICP-MS.

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