

APPLICATION NOTE

Trace Copper Contamination Using a 508 UV-VIS™ Spectrometer or ClearView® db Photometer

Problem

Contamination is a major concern for the semiconductor industry. With the advent of tin and tin/silver solders for lead-free/RoHS compliant electrodeposition, the risk of trace copper contamination (<20 ppm) due to leaching of copper into the acidic bath solutions requires real-time monitoring to ensure proper deposition.

Solution

By incorporating a real-time copper ion monitor into electrodeposition equipment, a technician can quickly identify when the plating solution needs to be replaced before viable product yields begin to drop.

Experimental Set-up

A proof of concept study was conducted with tin and silver/tin salt solutions dissolved into sulfuric acid to generate a plating solution. Subsequently, the plating solutions were spiked with serial additions of aqueous copper sulfate and measured with our GUIDED WAVE™ 508 UV-VIS™ Full Spectrum Process Analyzer coupled to our GUIDED WAVE 100 mm Teflon™ Axial Flow Cell.

Results

As shown in Figure 1, the 508 UV-VIS analyzer is able to discern the difference between 0 and 4 ppm Cu with a linear response up to 70 ppm Cu in Sn. The addition of Ag to the Sn Sulfuric Acid solution does not interfere with the optical determination of Cu ion concentration. To test the viability of a photometer, such as the ClearView® db, for the real-time monitoring of trace Cu contamination of electroplating solutions, three visible wavelengths were selected for Multiple Linear Regression (MLR) on the spectral data for the 0-20 ppm Cu in Sn samples. As shown in Figure 2, a calibration was achieved which estimates the average error for a photometer would be +/-0.8 ppm over the calibration range.

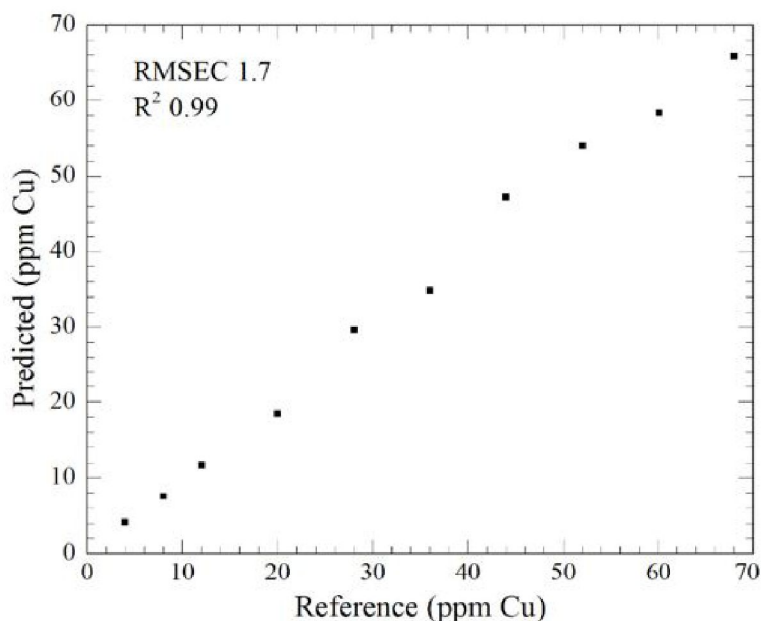


Figure 1: Partial Least Squares Regression of Cu (ppm concentration) in an Sn acidic plating solution.

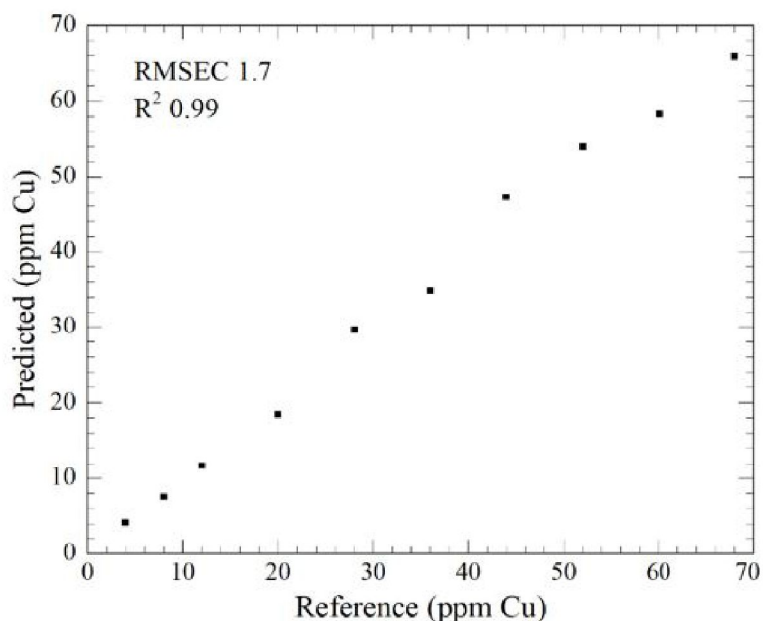


Figure 2: Multiple Linear Regression of 0-20 ppm Cu contamination of a Sn acidic plating solution.

Conclusion

Real time detection of trace (part per million) contamination of electroplating solutions can be achieved with both analyzers; the full spectrum 508 UV-VIS spectrometer or the ClearView db photometer. Understanding when to replace the plating solution, due to copper contamination can be achieved at a reduced cost with our ClearView db photometer and a 100 mm Teflon™ Axial Flow Cell. Either analyzer can be installed alongside existing plating systems, or manufacturers of plating workstations can purchase an OEM version of the analyzer, to monitor the buildup of copper ions in Sn and Sn/Ag sulfuric acid plating solutions. The proof of concept study presented in this application note illustrates that our process analyzers can detect as little as 4 ppm copper in the Sn and Ag plating solution. Contact Process Insights for help in deciding on the best analyzer for your application.

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