Abstract #2382, 224th ECS Meeting, © 2013 The Electrochemical Society

The Advanced Monitoring of Organic Additives in Copper Electroplating Baths

Michael Pavlov, Xiaoxuan Sun*,
Eugene Shalyt and Peter Bratin
ECI Technology, Totowa, New Jersey
*Columbia University, New York

While the semiconductor manufacturers continue reducing the size of copper plated features, it is becoming more and more critical to obtain more accurate information about the composition of plating solutions.

With miniaturization of trenches and vias, the modern plating chemistries are continuously being modified to provide void free filing. These modifications typically include significant modifications of organic additive systems, while the inorganic components stay mostly the same with changes only to the concentration ranges.

For appropriate control of plating bath, most of organic additive systems require analysis of multiple individual components. Typical plating composition includes three organic additives commonly named Suppressor, Accelerator and Leveler [1]. Recently, four organic component system has been analyzed using the bench analyzer and online analyzer. The results for calibration and analysis of Leveler 2 component are presented on Figure 1 and 2.

Depending on the plating process, the analysis might be required immediately after bath mixing or (and) continuously during the plating process, with analysis at a scheduled frequency. It is important to provide analytical results in a very short period of time to prevent possible loss related to the bath preparation and overdosing or dilution due to the malfunctioning of hardware parts.

In order to meet tight accuracy and reproducibility requirements and provide results in short period of time, new analytical techniques have been developed. These techniques do not use conventional CVS electrochemical signals such as stripping area, but variations derived from it. The newly developed electrochemical procedures allow to better separate the multiple components of additives in the plating solutions.

Figure 2 shows results for one of such component in the plating bath, analyzed using new analytical technique with time of analysis below 10 minutes.

These new techniques do not use special reagents for analysis and require only small amount of standard solution used for automatic system validation and calibration.

When bath is being utilized for product plating, there is a possibility to accumulate external contaminants and (or) generated by-products. This article will focus on novel approaches in electrochemical analysis of various plating solutions used in semiconductor manufacturing.

The data obtained for four organic additives will be reported. Work related to detection of by-products in the bath will be also presented.

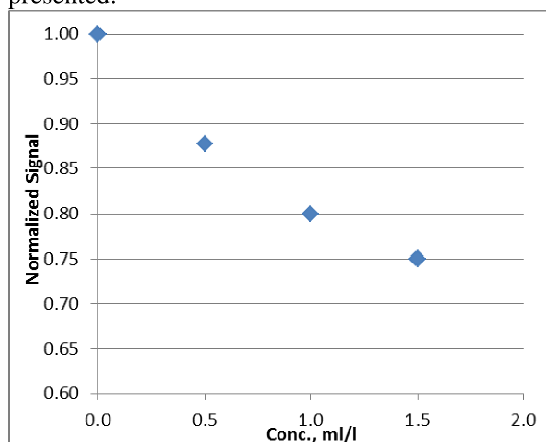

Figure 1. Response curve for Leveler 2

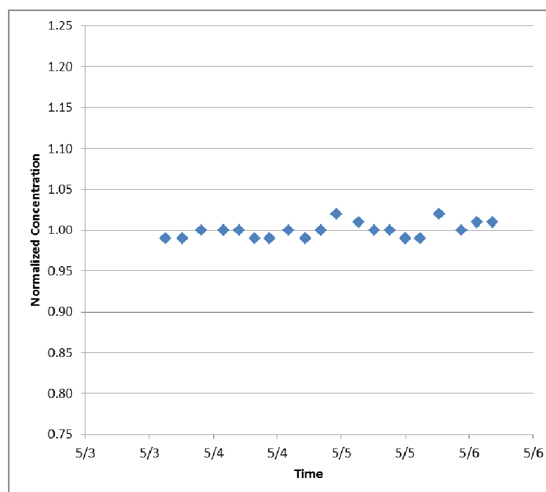

Figure 2. Online results for Leveler 2, RSD <0.9%

References:
1. Bratin, P., Chalyt, G., Pavlov, M., and Sandor R. “Automated On-Line Control of Plating Bath Additives Increases Wafer Yield”, Semicondutor Fabtech 14th Edition Summer 2001.