Real-time Monitoring of Cu Plating Process for Semiconductor Interconnect

Li Wang, YoungJoo Jee, Dae Wha Soh, and SangJeen Hong*

Department of Electronic Engineering, Myongji University, Yongin 38-2, Republic of Korea

Abstract : As the advanced packaging technology developing, Copper electro-plating processing has be wildly utilized in the semiconductor interconnect technique. Chemical solution monitoring methods, including PH and gravity measurement exist in industry, but economical and practical real-time monitoring has not been achieved yet. Red-green-blue (RGB) color sensor can successfully monitor the condition of $CuSO_4$ solution during electric copper plating process. Comparing the intensity variations of the RGB data and optical spectroscopy data, strong correlation between two in-situ sensors have shown.

Key Words : Copper electro-plating, Real-time monitoring, RGB sensor, OES sensor

1. INTRODUCTION

With the performance of high deposition rate and sufficient gap filling, copper electro-plating process becomes more and more popular in the semiconductor interconnect technique. In this paper we describe a real-time monitoring system based upon chromatic modulation which utilized polychromatic light for sensing changes within a physical system with simple analyzability and low price [1].

2. EXPERIMENT

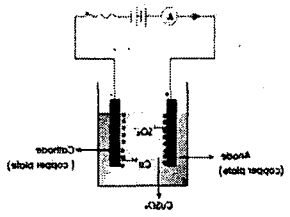

Fig.1

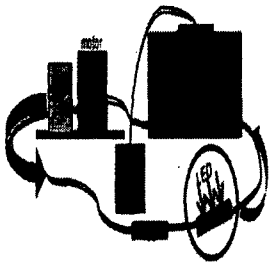

Fig.2

As the illustration of the Fig.1 and in order of the Fig. 2, we did an imitate experiment using a 50mm*200mm PCB board instead of a real silicon wafer.

3. RESULT & DISCUSSION

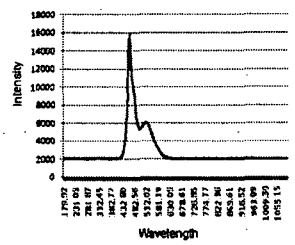

Fig.3 OES entirely wavelength in CEP

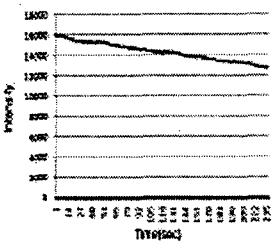

Fig.4 OES pick intensity variation

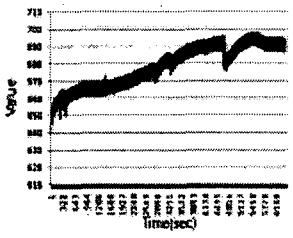

Fig.5 Green value variation

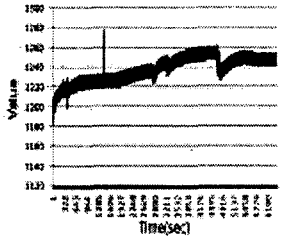

Fig.6 Red value variation

Fig.3 shows the wavelength intensity of light which pass through $CuSO_4$ solution. Cu^{2+} were consumed during the processing. And the solution color became light blue. The variety of the peak intensity is shown in Fig.4. It was obvious to see that the peak intensity fall as the Cu^{2+} consumed. Opposite the OES sensor, solution became the lighter, RGB sensor values the higher. As shown in Fig 5 and Fig 6, the values of the the green and the blue were increased simultaneously.

4. SUMMARY OR CONCLUSION

Our research utilized chromatic system to monitor the copper electroplating processing. By the experiment results, the value of chromatic data increased reasonably. Then we will measure the PCB board thickness and execute authentic experiment to find the just endpoint of the copper electro-plating processing.

5. ACKNOWLEDGMENTS

This research is supported by Small and Midsize Business Association, Industry-Academy Co-operation Laboratory with Hwabaek Engineering (ID: S5209E05200).

REFERENCES

[1] M. Beavan, "Colour measurement in optical metrology," PhD Dissertation, University of Liverpool, 1991.