Electrochemical characterization of copper films and comparison of strategies for corrosion protection

Sabine Reither\textsuperscript{a}, Maximilian Bonta\textsuperscript{a}, Silvia Larisegger\textsuperscript{a}, Michael Nelhiebel\textsuperscript{a}, Andreas Limbeck\textsuperscript{b}, Günter Fafilek\textsuperscript{b}

\textsuperscript{a}KAI, Center of Expertise in Automotive and Industrial Electronics, Europastraße 8, 9524 Villach, Austria
\textsuperscript{b}Institute of Chemical Technologies and Analytics, TU Wien, Getreidemarkt 9, 1060 Wien, Austria

Abstract

Copper is used in a wide range of applications because of its superb electrical and thermal conductivity, in addition to being a relatively noble metal. One area of application is the semiconductor industry, where copper meanwhile is also used in the periphery of devices, as heat sinks, printed connectors or bonding wires. To guarantee reliability in harsh environments and further miniaturization, copper corrosion has to be prevented to the best possible extent.

This work centers on the characterization of differently processed copper films, with varying texture and impurity-level, to study the impact of such effects on corrosion behavior and resistance. Strategies for inhibition of copper corrosion have been tested and will be presented in this contribution. The electrochemical characterization is done in a three electrode set-up by measuring open circuit potential, Tafel plots and electrochemical impedance spectroscopy (EIS). The surface of the sample is also analyzed by imaging techniques (optical microscopy and scanning electron microscopy (SEM)). Additionally, a new approach for determining the inhibitor layer mass by Laser Induced Breakdown Spectroscopy (LIBS) is introduced.

Results show that LIBS proved to be a quick and simple technique for layer thickness determination, given that the layer composition is known. By combining the information from electrochemical measurements and LIBS the efficiency of inhibitors for corrosion inhibition can be determined more thoroughly.

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