Chlorine Corrosion of Aluminum Interconnect from Laser Activated Parylene in Acoustic MEMS Arrays

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Corrosion of electrical interconnect wiring has been shown to cause interconnect failures which led to non-functioning devices. We report here our observation of corrosion of unpassivated Aluminum interconnect lines which were fabricated on glass substrates. These Aluminum lines were part of an integrated two dimensional acoustic MEMS array structure and chip on glass assembly. EDX was used as the primary analysis tool in this work with other complementary surface analysis techniques used to support the primary findings. Parylene, which was used to form an impedance matching coating layer for the integrated acoustic lens array was determined to be the most likely cause of these interconnect corrosion. We have proposed here a likely scenario where Chlorine is activated from Parylene in our fabrication process to cause corrosion. Our approach to suppress these corrosion failures will also be described.

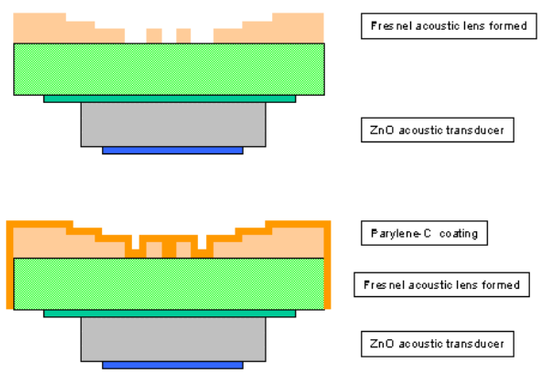

Figure 1. Acoustic ink jet print head fabrication and assembly build up process.

Figure 2. Scanning Electron Micrograph of Aluminum trace corrosion.

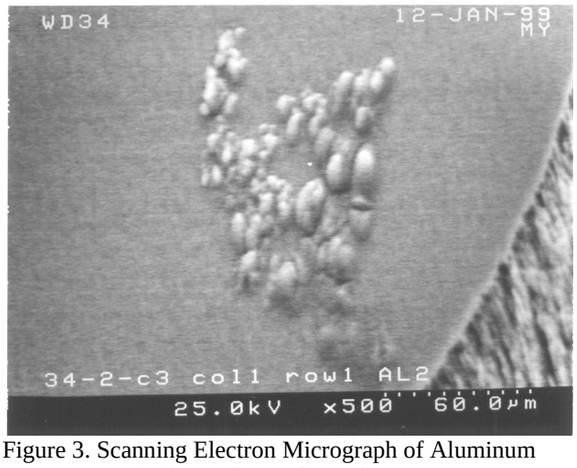

Figure 3. Scanning Electron Micrograph of Aluminum corrosion on ZnO transducer electrode.

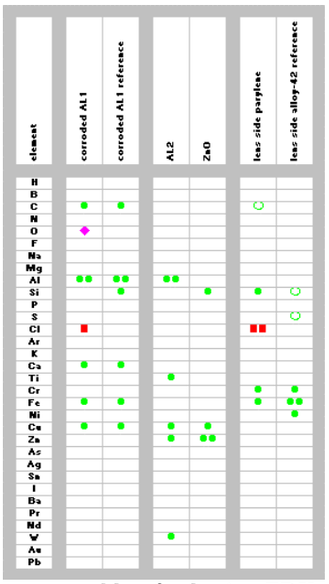

Table 1. Summary table of selective EDX elements for corrosion analysis (signal level: ●●: high ; ●: medium ; ❍: low ; ▪: corrosion contributing ; ◆: may contribute to corrosion ; ●: normal).

References

[1] R.D.Tacito and C.Steinbruchel, “Fine-Line Patterning of Parylene-n by Reactive Ion Etching for Application as an Interlayer Dielectric”, pp.1974-1977, J.Electrochem. Soc., Vol. 143, No. 6, June 1996.

[2] G.R.Yang, Y.P.Zhao, J.M.Neirynck, S.P.Murarka and R.J.Gutmann, “Chemical-Mechanical Polishing of Parylene N and Benzocyclobutene Films”, pp.3249-3255, J.Electrochem. Soc. Vol 144, No. 9, September 1997.

[3] M.Sato and Y. Arita, “Suppression of Aluminum Contamination in Polysilicon Reactive Ion Etching Using Highly Purified Chlorine Gas”, pp. 2541-2547, J. Electrochem. Soc., Vol. 144, No. 7, July 1997.

[4] T.Wada, M. Sugimoto and T. Ajiki, “The Influence of Passivation Layer on Aluminum Corrosion on Simulated Microelectronics Circuit Pattern”, pp732-735, J. Electrochem. Soc., Vol. 136, No. 3, March 1989.

[5] S. Lee and Y. Kuo, “Chlorine Plasma/Copper Reaction in a New Copper Dry Etching Process”, J. Electrochem. Soc., 148 (9) G524-G529 (2001).