

課題番号 : F-20-OS-0005
 利用形態 : 機器利用
 利用課題名(日本語) : E B 蒸着により作成した銀薄膜におけるエレクトロマイグレーション挙動の研究
 Program Title (English) : Electromigration behavior of silver thin film fabricated by EB deposition
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 キーワード/Keyword : Thin film, reliability, electromigration, 成膜・膜堆積

1. 概要 (Summary)

In this study, the EM of a silver thin film deposited on a glass substrate was examined at a current density of 8.89×10^5 A/cm² and room temperature of 15 °C. During the EM test, the new phenomenon of the thin-thread silver structures with a unique direction was noted. To explain this, finite element analysis was applied to simulate the temperature and direction of the current flow.

2. 実験 (Experimental)

【利用した主な装置】

EB 蒸着装置 (Model: UEP-2000 OT-H/C)

【実験方法】

The EB applied to the silver target (99.9%, AG-400251, The Nilaco Co.) transformed into the gaseous phase. When the silver ions were attached to the glass surface, the ions quickly precipitated into solid, forming the thin film. To obtain a high-quality thin film, the deposition process was conducted at a rate of 0.1 nm/s in a vacuum chamber with a pressure of 10^{-6} mbar. First, a 5-nm thick chromium thin film was coated as the adhesion layer between the glass substrate and silver. Then, silver was deposited until the thickness reached 300 nm.

3. 結果と考察 (Results and Discussion)

In this study, a silver thin film obtained by EB physical deposition was applied to investigate its microstructure evolution during EM test at a high

current density of 8.89×10^5 A/cm² and room temperature of 15 °C. During the EM test, the cathode and middle parts of the stripe exhibited significant changes in their morphology. Thin-thread and net-shaped silver structures were observed in the cathode and middle area, respectively. However, there were no changes in the morphology of the anode.

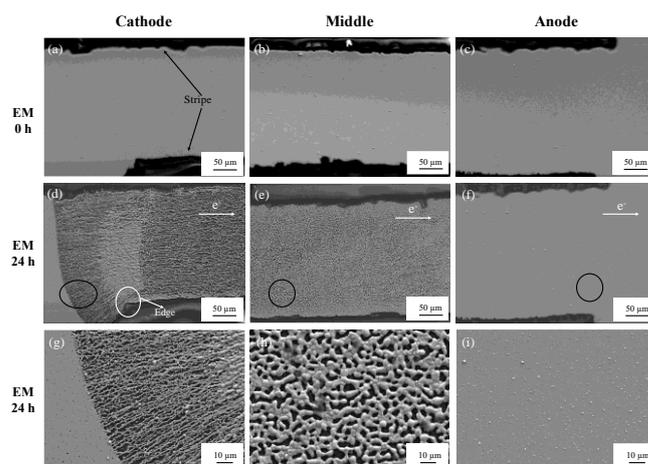


Fig.1. Morphology of the silver stripe: (a) Cathode, (b) middle area, and (c) anode before the EM test; (d) cathode, (e) middle area, and (f) anode after the EM test; and high magnification observation of the (g) cathode, (h) middle area, and (i) anode after the EM test.

4. その他・特記事項 (Others)

Thanks for Norizawa Sensei's technical support

5. 論文・学会発表 (Publication/Presentation)

Zhi Jin, Yu-An Shen, Fupeng Huo, Y.C. Chan, Hiroshi Nishikawa, *Journal of materials science*, accepted.

6. 関連特許 (Patent)

なし