Hirosaki Univ. Technology

Reliability evaluation method of Multilayer wiring

Accurate evaluation of electromigration damage

Overview

With the high integration of electronic devices, high temperature of metal wiring and high current density used in circuits are increasing. Then, electromigration (EM) damage due to metal fatigue becomes a problem, which may cause disconnection failure. Therefore, it is important to evaluate the reliability of wiring.

Conventional reliability evaluation methods include empirical equations (Black's equation), but tests for each wiring structure are necessary, and evaluation accuracy is also problematic. Since threshold current density of EM damage exists in multilayer wiring with via connections, evaluation studies of threshold current density have conventionally been conducted. However, evaluation of the EM damage process leading to the generation and growth of voids and disconnection has not been achieved, and a highly accurate evaluation method has been required.

In order to solve the above problems, we have developed a method for evaluating wire life and allowable current with high accuracy and simplicity. In the present invention, the parameters controlling EM damage can be specified and the atomic concentration distribution inside the wiring can be simulated. By utilizing this method, it is also possible to design an effective reservoir structure to improve the threshold current density.

Product Application

- Design of semiconductor integrated circuits
- Wiring design of electronic device
- Inspection device such as electronic device
- Computer Aided Engineering (CAE) analysis, etc.

IP Data

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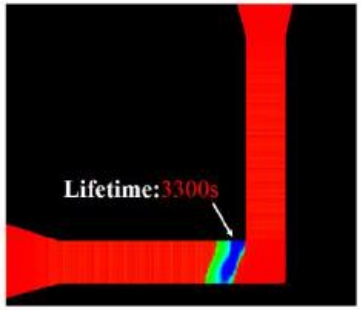
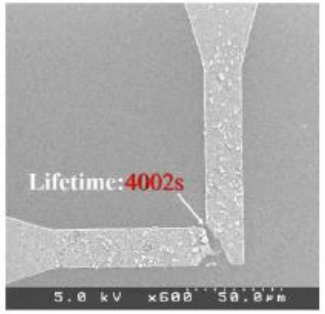


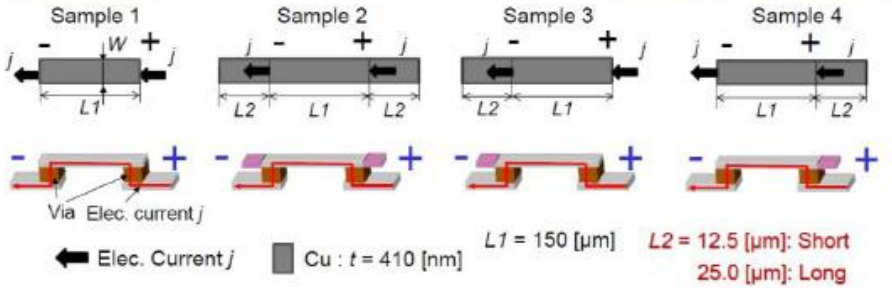


Prediction and experimental results of wiring life and wiring location (left: prediction, right: experimental results)

Comparison of simulation with different reservoir structures

Change in allowable current by the reservoir [MA/ cm²]

Sample type		1: none	2: both	3: only cathode	4: only anode
Reservoir length	Short 12.5 [μm]	0.77	0.76	0.82	0.71
	Long 25.0[μm]		0.76	0.88	0.67



Related Works

[1] Microelectronics Reliability, 118(2021),114060
[2] Mechanical Engineering Letters, Vol.8 (2022), Paper No.22-00035

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