摘　要

現今攜帶式電子產品的發展是朝向更輕薄短小功能更多樣化的趨勢發展，封裝技術的演進也應此需求而往體積更小導線間距更細微的技術演進，也因此具有細微導線間距、加工方便、符合環保要求等優點的異向性導電膠膜封裝技術便越來越受到各方的重視與發展。

本論文使用真實具功能的 IC 晶片，藉由異向性導電膠膜，採用相同熱壓製程參數與 PI 軟膜接合，形成 COF（chip-on-flex）封裝體，以探討此種封裝體的可撓曲特性。由於此種封裝體的可撓曲性為其設計應用上的一大特色，因此本論文研究主要經由實驗來探討其受環境影響下可撓曲特性的表現與變化。實驗主要分為兩大部分，第一部分為 COF 的電性可靠度與其撓曲行為變化，透過不同溫濕環境、熱循環、高溫老化等加速環境時效作用後，於常溫進行線路電阻值量測與四點彎矩抗彎測試；第二部分則是在不同溫濕環境，以不同頻率參數和位移控制方式進行整個 COF 封裝體結構的四點彎矩疲勞測試。

實驗結果發現，經過環境時效作用後的試片的線路電阻值並不會有改變，顯示其電性方面可靠度十方良好；而在四點彎矩測試方面，經過高溫高濕時效作用，其可彎曲程度下降，在接合面上有破壞面轉移的現象發生，而經過熱循環與高溫老化後，試片能承受較大彎曲變形而不失效。破壞面則始終發生於 ACF 膠材。在四點彎矩疲勞測試的結果上，我們可以發現隨溫濕環境的加劇，疲勞壽命值顯著的減少，表示試片無法承受長時間的反覆彎曲變形便失效，另外隨著測試頻率增加，疲勞壽命值增加，但 ACF 膠材遭受破壞的程度也有所提高。

Abstract

Chip-on-flex (COF) with anisotropic conductive film (ACF) assemblies is widely used in recent years because of their smaller packaged volume and flexibility. In this study, four-point bending test method was chosen to observe the flexible performance of the specimens.

The experiments were divided into two parts. In the first part, the accelerated environmental tests including high humidity (85 %RH) at high temperature (85 ^{o}C), high temperature aging（150 ^{o}C）, and thermal cycling test (-40 ^{o}C~125 ^{o}C). After different storage time of accelerated environmental tests, the COF assemblies were took out and tested at room temperature. Bending fatigue behavior of the COF assemblies was investigated as the second part. The displacement controlled bending fatigue tests were performed at 80 ^{o}C/85 %RH and 60 ^{o}C/85 %RH conditions with different frequencies.

The results show that the daisy-chain resistance of COF specimens were almost invariant during accelerated environmental tests. The flexibility of the COF assemblies decreased progressively with increasing aging time of the humidity test and the fracture mode was originally cohesive fracture and translated into interface fracture between ACF layer and substrate after the effect of humidity. However, the flexibility increased slightly with high temperature aging and thermal cycling. The transition phenomenon of the fracture mode didn't appear during the high temperature aging and thermal cycling tests.

In the bending fatigue experiments, with increasing the temperature of testing environment, fatigue life at low frequency test decay more apparently than that at high one. Finally, it is obtained that the ACF layer destroyed notably at high frequency than low frequency at high temperature and humidity environment.