A research and application of negative binomial EWMA control chart

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ABSTRACT

The traditional control chart for nonconformities (called C control chart) assumes that process nonconformities have Poisson distribution. In actuality however, the occurrence of nonconformities does not always observe Poisson distribution. For example, when nonconformities of wafers have clustering phenomenon in semiconductor production process, the process control based on Poisson distribution always underestimates the true average nonconformities and process variance. If the compound Poisson process is taken as the basis for process control, the quality feature could be described accurately. When the process has minor variation, the sensitivity of the exponentially weighted moving average (EWMA) control chart is higher than the C control chart and more accurately reflects the current situation of the process on the control chart. Hence, this study considers Poisson-Gamma compound distribution for the failure mechanism, and takes the Markov chain approach to calculate the average run length required by the EWMA control chart under different design parameters. Moreover, the EWMA control chart of Poisson-Gamma compound distribution was constructed and actual data from a wafer plant were employed to illustrate the model ’ s working. This study could be used for detecting minor process variations in wafer plants and improving the process quality.

Keywords : nonconformities; Compound Poisson distribution; Average run length; EWMA control chart

Table of Contents

封面內頁 簽名頁 授權書...iii 中文摘要...iv 英文摘要..v 誌謝..vi 目錄..vii 圖目錄...ix 表目錄...x 第一章　緒論...1 1.1 研究背景與動機...................................1 1.2 研究目的...3 1.3 研究方法...4 1.4 研究範圍與假設...................................4 1.5 研究架構...5 第二章　文獻探討......................................7 2.1 各類修正管制圖...................................10 2.2 考慮缺陷數與缺陷群聚現象管制圖....................13 2.3 EWMA管制圖..15 2.4 平均連串長度(ARL)介紹.............................16 2.5 積體電路的良率模式.................................17 2.5.1 複合卜瓦松模式…................................18 2.5.2 卜瓦松模式......................................19 2.5.3 負二項良率模式.................................20 2.5.4 Murphy模式.....................................22 2.5.5 指數分配良率...................................23 2.5.6 Okabe ’ s模式....................................23 第三章　負二項EWMA管制圖...............................25 3.1 負二項EWMA管制圖模式..............................25 3.2 負二項EWMA管制圖平均連串長度(ARL)計算推導..........30 3.3 負二項EWMA管制圖計算範例..........................34 3.4 製程平均缺陷數偏移之負二項EWMA管制圖..............36 第四章 實例應用..38 4.1 EWMA管制圖之 計算.................................39 4.2 尋找EWMA管制圖管制界限參數.........................47 4.3 製程平均缺陷數偏移之負二項EWMA管制圖 ....49 第五章　EWMA管制圖參數分析.............................51 5.1 製程平均缺陷數變動分析.............................51 5.2 卜瓦松與負二項EWMA管制圖之績效比較…................54 第六章　結論與未來研究方向.............................56 參考文獻..58

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