國立交通大學

顯示科技研究所

碩士論文

透明非晶態氧化銦鎵鋅薄膜電晶體研究與傳導機制建立

The study on channel thickness effects and transportation mechanism establishment for InGaZnO Thin-Film-Transistors

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摘　　要

藉由探討氧通量，退火，不同製程因素使得氧含量對於銦鎵鋅氧薄膜的特性影響，以提升非晶系銦鎵鋅氧薄膜電晶體的效能並藉由可靠度分析研究，推導出非晶系銦鎵鋅氧薄膜電晶體的傳導機制。一開始，先藉由氧通量的變化，來探討氧通量對薄膜特性的影響，而優化薄膜的半導體特性。另一方面，藉由退火改善了半導體整層薄膜的膜質，結果隨著退火溫度增高，臨界電壓會減小，其他電特性也隨之改善。進一步的，藉由引入不同的退火情境，來探討不同退火氣體對於薄膜修補的影響，找出適合退火氣體並且推導出銦鎵鋅氧薄膜電晶體傳導通道可分為前、後通道，而前通道主要受退火溫度的影響而後通道的氧空缺可被退火氣體氧、氮所填補。接下來，藉由探討真空、常壓環境下的可靠度分析，來探討外界環境對於非晶系銦鎵鋅氧薄膜電晶體效能的影響，結果發現正、負的可靠度分析分別受到外界氧氣、水氣的影響。最後藉由改變不同非晶系銦鎵鋅氧薄膜厚度探討前導通通道的厚度以及驗證可靠度分析的結果。

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ABSTRACT

The discussion of oxygen flux, annealing and the regulation factor causes the different oxygen content in indium gallium zinc oxygen thin film to promotes the a-IGZO TFT's quality and because of the research of reliability analysis, the transport mechanism have been derived in my thesis. In the beginning, we discuss the affect of oxygen content in the film by changing the oxygen flux and then optimize the semiconductor characteristic. On the other hand, we improved the semiconductor entire level thin film membrane by annealing, the result advanced along with the annealing temperature, the threshold voltage could reduce, other electricity characteristic also along with it improvement. Further, we discusses the different annealing gas regarding the thin film patching influence in different annealing situation and discovers suitable annealing gas to infer the a-IGZO TFT conduction channel to be possible to divide into the front and back channel. The annealing temperature mainly influence the front channel and the oxygen vacancy may fill up by the annealing oxygen、nitrogen gas. Meets down, we analyze the reliability in

vacuum and atmospheric environment to discusses the external affect of the a-IGZO TFT. The results generalize the positive and negative reliability analysis influences by the outside oxygen and moisture separately. Finally, by changing the difference of indium gallium zinc oxygen film thickness to derive the front channel thickness and prove the reliability results.

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