中文摘要

本研究以鋁金屬誘發非晶矽結晶之方法，探討以不同厚度的非晶矽對鋁誘發非晶矽結晶的影響，本研究以電漿輔助化學氣相沉積分別沉積 30、60、90 與 120 nm 的非晶矽層，接著以濺鍍法沉積 30 nm 的鋁層，再以退火溫度 350℃ 的溫度下進行持溫時間 15 分鐘與 30 分鐘的退火處理，並於蝕刻過後以光學顯微鏡、電子顯微鏡、X-Ray 繞射分析儀、拉曼光譜儀、霍爾量測及直流交流量測系統進行結晶性與電特性的分析。

本研究結果得知，不論任何鋁矽厚度比例於 15 或 30 分鐘退火過程中皆可有誘發跡象，但退火時間的增加對結晶具有正向的影響，當非晶矽厚度爲 30 nm 與鋁厚度爲 30 nm 之條件下誘發的結晶性最好，但會形成破裂狀的多晶矽薄膜無法完整連接起來導致電特性不佳。當非晶矽薄膜厚度增加則無此狀況發生，當非晶矽薄膜厚度達到 90 nm 與鋁層厚度爲 30 nm 之條件下所誘發的結果，在結晶性與電特性整體比較上具有一個較佳的表現。

並於研究過程中發現非晶矽薄膜厚度爲 120 nm 與鋁層厚度爲 30 nm 的厚度比例於退火持溫時間 15 分鐘後會出枝狀物的結構，並隨著退火時間的增加，枝狀物會向外擴展成長，此枝狀物之結晶方向混雜，並與碎形中擴散限制的聚集模態相似，於實驗中觀察到的晶粒則是經由此枝狀物所成長佈滿而成。而此厚度比例下的這些枝狀物結構在成長上有許多的隙縫與晶界存在，因此在電性上會比非晶矽厚度爲 60 nm 或 90 nm 與鋁層厚度爲 30 nm 的厚度比例下要來的差。

英文摘要

In this study, we analyze the effect of amorphous silicon (a-Si) film thickness on the poly-crystalline silicon quality in the aluminum induced crystalization process. Amorphous silicon was deposited on the oxided Si wafer by plasma enhanced chemical vapor deposition with film thickness of 30, 60, 90, or 120 nm. The aluminum layer with the thickness of 30 nm was then deposited on top of the a-Si film by sputtering method. The specimens were then annealed for 15 or 30 minutes under the annealing temperature of 350°C. Optical microscope, scanning electron microscope, X-ray diffractometer, Raman spectroscope, Hall and I-V measurement were performed on the Al-etched specimens to study the crystallinity and electric characteristics.

The results show that Si crystallization had already been induced after 15 or 30 minutes of annealing process. The crystallinity is proportional to the annealing. The specimen with a-Si/Al film thickness of 30/30 nm has the best crystallinity from the XRD and Raman results. However, the island-like crystallized Si did not make the mobility as good as it supposed to be. This is because these isolated Si-islands did not connect one other, which makes the carriers difficult to move from island to island. The specimen with a-Si/Al film thickness of 90/30 nm has the best electric characteristics in the tests.

In the specimen with a-Si/Al film thickness of 120/30 nm, there appears dendric Si crystallization on the surface of the top film. It is shown that the poly-Si grain of this specimen is composed of a lot of poly-Si dendrites inside. The orientation of these dendrites varies a lot, which will hinder the carriers to move freely. This makes the mobility of the specimen with a-Si/Al film thickness of 120/30 nm considerably lower than what we expect.