

利用氨氣/一氧化二氮電漿處理在鈦酸鋁/鈦酸鈷 複晶矽絕緣層之研究

學生：謝松齡

指導教授：雷添福 博士

國立交通大學

電子工程學系 電子研究所碩士班

摘 要

利用氧化爐管合成的高介電常數材料鈦酸鈷及鈦酸鋁，其可被運用在非揮發性記憶體元件、隨機存取記憶體、及金氧半場效電晶體閘及氧化層上。將其用來取代複晶矽氧化層時，我們可以提高耦合係數使得快閃記憶體的操作電壓可以降低，

在論文中，我們證明高溫金屬氧化製程不會造成穿遂氧化層特性的劣化，並研究有關於鈦酸鈷及鈦酸鋁的物性，電性以及可靠度分析。我們首次將氧化前電漿處理及氧化後電漿處理的方式運用在這兩個介電層的製造上。結果顯示經由氨氣或一氧化二氮氣體高密度電漿化學氣相沈積做氧化前處理後，使得鈦酸鈷及鈦酸鋁崩潰電場，及可靠度方面具有較佳的表現，而氧化後處理的方式將使介電層的可靠度降低。經過氧化前氨氣或一氧化二氮電漿處理製程後，將使得其更有潛力應用在非揮發性記憶體複晶矽介電層中。

Study of NiTiO/CoTiO Interpoly Dielectrics with NH₃/N₂O Plasma Treatment

Student: Song-Lin Shei

Advisor: Dr. Tan-Fu Lei

Department of Electronics Engineering &
Institute of Electronics
National Chiao Tung University

ABSTRACT

Cobalt-titanium oxide and nickel-titanium oxide was formed by furnace oxidation. It can be used for the interpoly dielectric for nonvolatile memory, storage capacitor dielectric for DRAM and gate oxide for MOSFET applications. When it was used for the interpoly dielectric, low voltage operation flash memory cell with high coupling ratio can be achieved.

In this thesis, we demonstrate the quality of tunnel oxide without degradation during the high temperature process of metal oxidation. Physical, electrical and reliability characteristics of CoTiO and NiTiO were studied in this research. For the first time, we use the plasma pre-oxidation treatment and post-oxidation treatment in the fabrication process of these two dielectrics. From our results, after the NH₃ or N₂O plasma pre-oxidation treatment, basic electrical characteristics of CoTiO and NiTiO such as breakdown field, and time dependent dielectric breakdown (TDDB) were improved and we also show that post-oxidation treatment will degrade the reliability. After NH₃ or N₂O plasma pre-oxidation treatment, CoTiO and NiTiO reveal potential for application in nonvolatile memory.