P - 31

Deposition Mechanism of $SrTiO_3$ Thin Films by Plasma Enhanced Metal Organic Chemical Vapor Deposition

R.-J. Choi[1], T. Jeong[1], Y. B. Hahn[1*] and J. Hong[2]
1. School of Chemical Engineering & Technology, Chonbuk National University
2. Samsung Semiconductors R & D Center

플라즈마 MOCVD를 이용한 $SrTiO_3$ 박막 증착 메카니즘

최락준[1], 정탁[1], 한윤봉[1*],홍진[2]
1. 전북대학교 화학공학부, 2. 삼성반도체 연구소,

Strontium-based high dielectric materials such as $SrTiO_3$ and $(Ba,Sr)TiO_3$ have attracted great interest in recent years because of their high dielectric constant and small variation of electrical properties with frequency and aging treatment. Main application is capacitor dielectrics for very high density dynamic random access memory (DRAM) cells. Many research results for fabricating $SrTiO_3$ thin films by MOCVD and rf magnetron sputtering have been reported, but little work has been done on the plasma enhanced metal organic chemical vapor deposition (PEMOCVD) films of $SrTiO_3$, especially in terms of deposition mechanism.

In this work, to study the growth characteristics and deposition mechanism of $SrTiO_3$ thin films, the films were deposited on Pt/Si and Ir/Si substrates by the PEMOCVD using $Ti(O\text{-}i\text{-}C_3H_7)_4$, bis(2,2,6,6-tetramethyl-3,5-heptanedionato) strontium ($Sr(tmhd)_2$) and oxygen under various conditions.

The deposition rates were quite dependent on bubbler temperature, substrate temperature and rf source power. The dissociation of $Ti(O\text{-}i\text{-}C_3H_7)_4$ was substantially enhanced by increasing the rf source power, while that of $Sr(tmhd)_2$ increased with the substrate temperature. The deposition rate and crystallinity of as-deposited $SrTiO_3$ films were also affected by carrier gas flow rate, leading to substantial amount of $SrCO_3$ formed with higher flow rate (≥ 160 sccm Ar). Surface morphology showed a smooth surface and good adhesion at the interface. Based on the growth characteristics of films, a deposition mechanism of PECVD $SrTiO_3$ films was proposed. It was found that the deposition of $SrTiO_3$ films was controlled by the decomposition rate of $Sr(tmhd)_2$ on the substrate surface. The optimum deposition conditions obtained were: bubbler temperatures (T_b) = 60 °C for $Ti(O\text{-}i\text{-}C_3H_7)_4$ and 220 °C for $Sr(tmhd)_2$, substrate temperature (T_s) = 550 °C, 130 sccm O_2, 160 W rf source power with carrier gas flow rates of 40 and 130 sccm Ar for titanium and strontium precursors, respectively.

* Author for all correspondence. Electronic mail: ybhahn@che.chonbuk.ac.kr.