Electrical Improvement of MIS Capacitor with HfAlOx Gate Dielectrics Treated by Dual Plasma Treatment

I-Chung Deng,Kow-Ming Chang,Ting-Chia Chang,Po-Chun Chang,Bo-Wen Huang,吳建宏
Electronics Engineering
Engineering
rossiwu

Abstract

High dielectric constant materials (high-k) such as Hf-based thin films are the promising candidates for 45-nm CMOS technology. It has been described that nitridation processes could improve thermal stability and dielectric constants of Hf-based dielectrics. Furthermore, fluorine incorporation into high-k dielectric was also proposed in order to suppress leakage current and passivate defects. In this study, we examined dual plasma treatment (CF4 pretreatment and N2 post-treatment) on HfAlOx thin films in order to improve electrical characteristics. Based on our experimental results, HfAlOx Metal-Insulator-Semiconductor (MIS) capacitor properties such as capacitance density, gate leakage current density, and hysteresis could be successfully improved. Compared to untreated samples, capacitance is 42.5 % higher and gate leakage is suppressed about three orders when dual plasma treatment is used. According to this study, dual plasma treatment would be an effective technology to improve the electrical characteristic of HfAlOx thin films.

Keyword：HfAlOx, Dual Plasma Treatment