Improved Retention Characteristic in Polycrystalline Silicon-Oxide-Hafnium Oxide-Oxide-Silicon-Type Nonvolatile Memory with Robust Tunnel Oxynitride

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Abstract

In this paper, we present a simple novel process for forming a robust and reliable oxynitride dielectric with a high nitrogen content. It is highly suitable for n-channel metal–oxide–semiconductor field-effect transistor (nMOSFETs) and polycrystalline silicon–oxide–hafnium oxide–oxide–silicon (SOHOS)-type memory applications. The proposed approach is realized by using chemical oxide with ammonia (NH3) nitridation followed by reoxidation with oxygen (O2). The novel oxynitride process is not only compatible with the standard complementary metal–oxide–semiconductor (CMOS) process, but also can ensure the improvement of flash memory with low-cost manufacturing. The characteristics of nMOSFETs and SOHOS-type nonvolatile memories (NVMs) with a robust oxynitride as a gate oxide or tunnel oxide are studied to demonstrate their advantages such as the retardation of the stress-induced trap generation during constant-voltage stress (CVS), the program/erase behaviors, cycling endurance, and data retention. The results indicate that the proposed robust oxynitride is suitable for future nonvolatile flash memory technology application.

Keyword：SOHOS, NVM, Oxynitride