Controlling Base-SiO_2 Density of Low-Leakage 1.6 nm Gate-SiON for High-Performance and Highly Reliable n/pFETs

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Abstract

We will report the importance of high-density base-SiO_2 for nitridation, and demonstrate a low-leakage and highly reliable 1.6 nm gate-SiON without performance degradation in n/pFETs using the radical process. It was found that the high-density 1.6 nm SiO_2 is ten times more reliable than the low-density SiO_2 in n/pFETs and is suitable for the base layer of radical nitridation due to maintaining the surface nitridation of the SiO_2 and the ideal SiON/Si-substrate interface. The 1.6 nm SiON with the high-density base-SiO_2 produces comparable drivability in n/pFETs, and has one and half orders of magnitude less gate leakage in nFETs, one order of magnitude less gate leakage in pFETs, and ten times more reliable in n/pFETs than the 1.6 nm SiO_2.