Low-energy Nitrogen Plasmas for 65-nm node Oxynitride Gate Dielectrics: A Correlation of Plasma Characteristics and Device Parameters

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Ultra-thin oxynitride gate dielectrics (EOT 1.1 to 1.2 nm) have been prepared using quasi-remote inductively coupled nitrogen plasmas. A correlation has been established, for the first time, between device characteristics and measurements of the nitrogen plasma characteristics. It is found that reducing the density of high-energy electrons in the plasma results in 5% improved electron and hole low-field mobilities and 100% improved NBTI reliability. These improvements in plasma nitridation technology enable the extension of oxynitride gate dielectrics to the 65-nm technology node specifications.