The Interface States at SiO₂/polysilicon and SiO₂/monosilicon Interface Influence on N-polysilicon/oxide/N-monosilicon Capacitance

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The interface states have a very significant role in the components containing MOS structures. We study the interface states densities effect at SiO₂/ Poly-silicon and SiO₂/ mono-silicon surfaces on metal/poly-silicon /oxide/ mono-silicon capacitance. Then, a mono-dimensional simulation of capacitance-voltage characteristics of MSPO is presented [1]. The numerical solution of Poisson equation and the determination of the charge variation in the structure induced by an application of external bias (V_G) allow us to simulate the capacitance-voltage MSPO characteristics. The geometrical model assumes that the poly-silicon layer is composed of a succession of defined mean grain size crystallites, separated by lateral grain boundary, which are parallel to the poly-silicon/ oxide interface.

The interface states of mono-silicon/SiO₂ shift the part of the curve that corresponds to the inversion of the substrate (mono-silicon) towards the negative voltage as it appears in Fig. 1. A shift towards the positive voltage of the inversion in poly-silicon layer for the interface states SiO₂ / poly-silicon is shown in Fig 2-a. The Polycrystalline layer is in depletion. A peak appears at the level of the minimum corresponding Poly-silicon layer.

If the Poly-silicon doping concentration is 10¹⁹ cm⁻³, the effect of the interface states disappears, which is confirmed by Fig. 2-b. The density of the traps becomes negligible in front of the doping concentration.

Our results are identical to those given by C. Leveugle on capacitances Poly-silicon/SiO₂/ mono-silicon [2].

Fig.1: Interface states at monosilicon/SiO₂-effect on Quasi-static capacitance Polysilicon doping= monosilicon doping= 10¹⁷ cm⁻³.

References


Fig. 2: Interface states at polysilicon/SiO$_2$ effect on Quasi-static capacitance

(a) Polysilicon doping = monosilicon doping = $10^{17}$ cm$^{-3}$,
(b) Polysilicon doping = $10^{19}$ cm$^{-3}$, monosilicon doping = $10^{17}$ cm$^{-3}$.