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Surface passivation effect on quasi steady state photoconductance technique measurements of lifetime in bare multicrystalline silicon wafers

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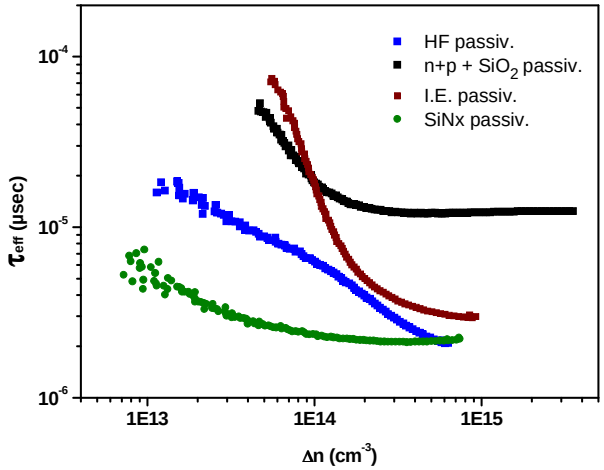
Abstract.

In this work we have examined the behavior of the effective minority carrier lifetime (τ_{eff}) in the multicrystalline (Mc-Si) silicon wafers with the excess carrier using different surface passivation techniques by means of the quasi steady state photoconductance decay (QSSPC) measurements. The QSSPC measurements implemented on the same sample give an effective lifetime of 12.2, 2.2, 3 and 2 µsec with phosphorous diffusion n^+p emitter, SiNx layer, Iodine-ethanol (IE) and hydrofluoric acid (HF) passivation respectively. It was observed that the SiNx give the same results as the HF surface passivation and neutralize the traps density in the bulk more efficiently compared with other passivation ways. A lightly doped n^+p emitter seems to be the best passivation way for a low quality Mc-Si wafer in which a high injection level of excess carrier cannot be reached ($\Delta n \sim 10^{16}$ cm^{-3}).

Based on the obtained results, we suggest for bare silicon multicrystalline wafers the use of a very sallow n+p phosphorous diffusion emitter during measurements of effective lifetime of minority charge carriers with QSSPC technique to avoid the instability and versatility of measured values obtained in other passivation ways.



τ_{eff} behavior vs. excess carrier density with different surface passivation techniques (Experimental results)