Applied Physics a

Volume 124, Issue 1, 2018, Pages 1-9

Mechanism for phosphorus deactivation in silicon-based Schottkydiodes submitted to MW-ECR hydrogen plasma

D.BELFENNACHE, D.MADI, N.BRIHI, M.S.Aida, M.A.SAEED

Abstract: Current work reveals the deactivation mechanism of phosphorus in silicon-based Schottky diodes. Microwave plasma power(P) was fixed at 650 W to observe the variation in different operational parameters of diodes such as initial phosphorusconcentration, flux and hydrogenation temperature (TMWH) and process time (t). The analysis of variation in concentrationof phosphorus by hydrogenation has been carried out by capacitance–voltage (C–V) measurements to monitor the dopingactivation/deactivation. The results clearly show that the atomic species H+H is dominant in the reactors MW-ECR plasma.Therefore, the rates and depth of neutralization were obtained in the low phosphorus-doped silicon sample. The H becomesH0 and prefers an interaction with another H0 instead of gaining an electron to become a negative ion. The hydrogenationtemperature study indicates that the deactivation rate of phosphorus is achieved in a complex manner. Indeed, as the hydrogenationtemperatureincreases,deactivationof phosphorus also increasestill saturationat 250 °C.Athigher temperature,lowor evenno phosphorus–hydrogen complexexistsdue totheirthermaldissociation. The same behaviorwasconfirmedbylonghydrogenation.

Keywords : MW-ECR plasma, Hydrogenation, phosphorus deactivation, C–V measurement