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EVOLUTIONS OF GRAIN BOUNDARY RECOMBINATION ACTIVITY IN POLYCRYSTALLINE SILICON INVESTIGATED BY LBIC MAPPING AND DLTS

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In large grained polycrystalline silicon, the recombination activity of grain boundaries (G.B.'s) is typically heterogeneous. This activity may be evaluated by the determination of interfacial recombination velocity S ; which is related to the presence of deep trap levels at G.B.'s.

Photoconductance and LBIC mapping at $\lambda = 940$ nm have been used to evaluate S , while D.L.T.S. measurements, applied to the space charge region of G.B.'s yield activation energy E_T , density N_T and capture cross section σ_T of associated centres.

In as-grown Polyx wafers, S is generally found in the range between 10^3 - 10^4 cm.s⁻¹ and deep trap levels are located within the mid gap.

Annealings in argon at temperatures around 700°C increase S and N_T , while E_T and σ_T remain generally constant. These results indicate that the increase of S is due to that of N_T only, and the nature of the recombination centre source is not changed.

To reduce the recombination activity of G.B.'s, annealings in hydrogen gas flow at 280°C during 2h have been used /1/. The comparison of the measured characteristic values shows that S decreases by one order of magnitude at least. D.L.T.S. indicate that N_T decreases, while E_T and σ_T are not affected by the treatment.

The preceding results could be explained assuming that hydrogen passivation is not extended to the entire G.B. area and that in the region in which hydrogen has penetrated, all the recombination centres can be passivated. This last evolution is reversible, as annealing the wafers in argon at 350°C during 2 hours is sufficient to reconstitute the initial value of S , suggesting that Si-H bonds are not formed.

Reference

/1/ H. AMZIL, Thèse d'Etat Marseille 1985.

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