shows the maximum at that doping ratio. In contrast, in the present work which is based on the junction properties we have successfully characterized B-doped a-Si:H into three categories of conduction type in terms of "dominant" carrier concentration; n-type for $B_2H_6/SiH_4<10^{-7}$, intrinsic for $B_2H_6/SiH_4\sim 10^{-6}$, and p-type for $B_2H_6/SiH_4>10^{-5}$.

On discussing the C-V characteristics of undoped a-Si:H/p c-Si heterojunctions, it is noteworthy that near the interface between undoped a-Si:H and p c-Si the energy band of undoped a-Si:H shows an upward bending, while the energy band of p c-Si shows a downward bending. This is because the conduction type of undoped a-Si:H is found to be n-type.

2-4. Summary

(1) The electrical properties of undoped a-Si:H/p c-Si heterojunctions can be investigated in Mg/a-Si:H/p c-Si diodes, because the Mg/undoped a-Si:H contacts are found to be Ohmic.

(2) In the undoped a-Si:H/p c-Si heterojunctions, the depletion regions are formed in both sides of a-Si:H and p c-Si, and these heterojunctions behave like a p-n junction because the conduction type of undoped a-Si:H is n-type.

(3) P-doped and undoped a-Si:H films make a rectifying contact with Au, Pt, Al, and p^+ c-Si, but those form an Ohmic contact with Mg and n^+ c-Si, indicating that majority carriers in those films are electrons.

(4) B-doped a-Si:H films, which are deposited in the range of $7\times10^{-7}\leq B_2H_6/SiH_4\leq 3\times10^{-6}$, form a rectifying contact with all of the metals(Au,Mg) and c-Si(n^+,p^+), suggesting that the films should be intrinsic.

(5) B-doped a-Si:H films for $B_2H_6/SiH_4\geq 1.5\times10^{-5}$ make a rectifying contact with Mg and n^+ c-Si, while those films form an Ohmic contact with Au and p^+ c-Si, indicating that majority carriers in those films are holes.

(6) Although the conduction type of B-doped a-Si:H changes from n-type to p-type at $B_2H_6/SiH_4\sim 10^{-6}$ from the study of the

junction properties, the minimum conductivity appears at $B_2H_6/SiH_4 \sim 10^{-4}$. This is simply because the value of $\mu_p p$ becomes nearly equal to that of $\mu_n n$ at the gas ratio of 10^{-4}.

(7) Al does not form an Ohmic contact with undoped and n^+ a-Si:H.