【P-14】

The effects of plasma exposure and annealing ambient on shallow junction formation using PSII

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In plasma doping process, the effects of ion and depositing species on the wafer should be considered, because the wafer is exposed to plasma. Generally, the working time should be increased, as decreasing the pulse repetition rate in order to keep the same dose. To investigate the effect of deposition, the wafer was implanted to have the same amount of boron with various working times. Subsequently, as-implanted wafer was annealed at 1000 ℃ for 25 seconds in vacuum. As increasing the working time (i.e. plasma exposure time), sheet resistance was measured to be decreased gradually. It means that deposited boron during implantation played an important role as additional dose.

To activate implanted boron, the annealing process is necessary. For the formation of shallow junction, RTA process is usually required. The wafer should be annealed in vacuum or nitrogen ambient to prevent the formation of oxide layer on the surface. In vacuum annealing, the amount of out-diffused boron was severe, reaching about 50 % of implanted dose. However, in nitrogen ambient, the amount of out-diffused boron was greatly reduced and the nitrogen pressure during annealing was very important. Also, as increasing the annealing time from spike to 15 seconds, the amount of out-diffused boron was gradually increased.

In this study, we investigated the effect of deposited boron and the effect of gas ambient during annealing.