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Diffusion Behaviors of B and P at the Interfaces of Si/SiO_2 Multilayer System After the Annealing Process

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The doping of semiconducting elements is essential for the development of silicon quantum dot (QD) solar cells. Especially the doping elements should be activated by substitution at the crystalline sites in the crystalline silicon QDs. However, no analysis technique has been developed for the analysis of the activated dopants in silicon QDs in SiO_2 matrix.

Secondary ion mass spectrometry (SIMS) is a powerful technique for the in-depth analysis of solid materials and the impurities analysis of boron and phosphorus in semiconductor materials. For the study of diffusion behaviour of B and P by SIMS, Si/SiO_2 multilayer films doped by B or P were fabricated and annealed at high temperatures for the activated doping of B and P. The distributions of doping elements were analyzed by SIMS.

Boron found to be preferentially distributed in Si layer rather than the SiO_2 layer. Especially the B in the Si layers was separated to two components of an interfacial component and a central one. The central component was understood as the activated elements. On the other hand, phosphorus did not show any preferred diffusion.

Keywords: SIMS, multilayer film, annealing, sillicon quantum dot