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TEM Observations of Heavily Boron-Doped Etch-Stop Layers

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The microstructures and defects of the etch-stop layers and the p^+ layers have been studied using transmission electron microscopy (TEM). Most of the defects in the p^+ layers are found to be stacking faults generated during thermal oxidation. TEM observations of the etch-stop layers and the p^+ layers reveal unambiguously that etch-stop occurs within the defect-segregated regions of the p^+ layers. It is clear from our results that the segregation of defects can play an important role in elucidating both the heavily doped etch-stop mechanism and the mechanical characteristics of the p^+ layers.

1. Introduction

Heavily boron-doped silicon (p^+-Si) has been widely known as a very effective means of etch-stop and has been successfully employed for the fabrication of various microsensors and microactuators. Most of the alkaline silicon etchants such as KOH, hydrazine and ethylenediamine-pyrocatechol-water (EPW) exhibit a drastic reduction in etch rate for the boron concentrations above a critical value, approximately 10^{19}~10^{20} cm^{-3}. Despite extensive efforts to clarify the mechanism of the heavily doped etch-stop in silicon,[1,2] the role of heavy boron doping in etch-stop has not been fully understood yet. It is conceivable that the defects generated by internal stress have influence on the etch-stop behavior and mechanical properties of p^+ layers. Until now, there have not been any reports of direct observations of defects in the layer where the etching is actually terminated. In the present