

Oxygen-related donors in Germanium doped Czochralski Silicon

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Intrinsic point defects play an important role on the yield of silicon devices in modern microelectronic industry. During the growth of Czochralski (CZ) silicon crystals from the melting point to room temperature, grown-in voids are formed with densities between 10^5 and 10^7 /cm³. It has been reported that voids can deteriorate gate oxide integrity (GOI) yield and enhance leakage current if they are located near the Si wafer surface. In the last decade, the nature, the formation behavior, and the techniques to control voids have been studied extensively. In recent, it was reported that the small number of germanium atoms has been doped into Si crystals to suppress voids^[1], and high quality denuded zones in Ge-doped CZ silicon wafer could be achieved^[2]. That means that Ge-doped CZ silicon is benefit of controlling microdefects and can be used in microelectronic industry.

In this paper, the oxygen-related donors including thermal donors and new donors in Ge-doped CZ silicon have been investigated. Three CZ silicon ingots with different germanium concentration were used in the

experiments. The samples were treated in one or two-step annealing. And then the oxygen concentration and carrier concentration were measured. It was found that germanium enhanced the formation of thermal donors, as reported in the previous work. However, it was also found that new donors were strongly enhanced due to Ge-doping. Furthermore, new defects related to germanium that formed at about 1100°C were detected. The characteristics and the possible formation mechanism of the defects were discussed.

Reference:

1. Deren Yang, et al, Journal of Crystal Growth, 243 (2002), P371—374
2. Xuegong Yu, Deren Yang et al, Journal of Crystal Growth 250(2003) , P359-363

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