Ga\textsubscript{2}O\textsubscript{3}, one of wide-band-gap semiconductor materials, is attracting attention as a next-generation power semiconductor. Since ion implantation process is important in device fabrication, we evaluated the dopant activation process and the crystal defect caused by ion implantation.

**Experimental Conditions**
- Substation: Unintentionally-doped n type \( \beta \)-Ga\textsubscript{2}O\textsubscript{3} sub.
- Surface Orientation: (-201)

**Ion implantation**
- dopant: Si\textsuperscript{+}
- Implantation energy: 100 keV
- Wafer tilt: 7°
- dose quantity: non dope (Ref.) 1E11, 2E12, 5E13, 1E15 (atoms/cm\textsuperscript{2})

**Annealing**
- Nitrogen gas atmosphere for 30 min
- Anneal temperature: 800°C, 1000°C

**Evaluation of ion implantation process**
- Dopant concentration (SIMS analysis)
- Crystal structure (Raman Spectroscopy)
- Ion implantation defect (Cathodoluminescence (CL), TEM)
- Carrier concentration (SCM)

**SIMS analysis results after annealing**
- The differences in Si diffusion depending on annealing temperature and dose quantity.

**Raman spectrum after ion implantation**
- Crystal structural changes by ion implantation.

**CL analysis results after ion implantation**
- Observation of ion implantation defects distribution.

**TEM image after ion implantation**
- Observation of ion implantation defects distribution.

**1000°C annealing sample has low activation rate in high concentration area.**

Various analytical methods are applicable to optimize ion implantation process of Ga\textsubscript{2}O\textsubscript{3}.