P1-001 << 분과초청 >>

The Study of DNA Damage Induced by Atmospheric Pressure Plasma Jet and Their Mechanisms

Yeunsoo Park, Mi-Young Song, Jung-Sik Yoon

Fundamental Technology Division, Plasma Technology Research Center, National Fusion Research Institite

The goals of this study are to elucidate the plasma effects on DNA molecules to apply some plasma based applications and also to find out the mechanisms of plasma-induced DNA damage in biomolecule. Nonthermal atmospheric pressure plasma has much potential for medical, agricultural and food applications for the future. The atmospheric pressure plasma jet (APPJ) contains radicals, charged particles, low energy electrons, excited molecules and UV light. It has been started doing experiments using APPJ at the early 21th. And some recent results showed that APPJ has a possibility to apply to new fields like mentioned above. But it is kind of at the very early stages of plasma based application. It is definitely necessary much of theoretical and experimental studies to further understanding to use nonthermal atmospheric pressure plasma in biomedical, agriculture and food parts. Here we introduce a new experimental system to study plasma effects on biomolecules. And we will show some recent results of LEE-induced DNA damage using electron irradiation apparatus under ultra-high vacuum.

Keywords: DNA damage, Atmospheric Pressure Plasma Jet, Plasma applications

P1-002 << 분과초청 >>

Strain-Relaxed SiGe Layer on Si Formed by PIII&D Technology

Seung Hee Han, Kyunghun Kim, Sung Min Kim, Jinhyeok Jang

Photo-electronic Hybrids Research Center, Korea Institute of Science and Technology

Strain-relaxed SiGe layer on Si substrate has numerous potential applications for electronic and opto- electronic devices. SiGe layer must have a high degree of strain relaxation and a low dislocation density. Conventionally, strain-relaxed SiGe on Si has been manufactured using compositionally graded buffers, in which very thick SiGe buffers of several micrometers are grown on a Si substrate with Ge composition increasing from the Si substrate to the surface. In this study, a new plasma process, i.e., the combination of PIII&D and HiPIMS, was adopted to implant Ge ions into Si wafer for direct formation of SiGe layer on Si substrate. Due to the high peak power density applied the Ge sputtering target during HiPIMS operation, a large fraction of sputtered Ge atoms is ionized. If the negative high voltage pulse applied to the sample stage in PIII&D system is synchronized with the pulsed Ge plasma, the ion implantation of Ge ions can be successfully accomplished. The PIII&D system for Ge ion implantation on Si (100) substrate was equipped with 3”-magnetron sputtering guns with Ge and Si target, which were operated with a HiPIMS pulsed-DC power supply. The sample stage with Si substrate was pulse-biased using a separate hard-tube pulser. During the implantation operation, HiPIMS pulse and substrate’s negative bias pulse were synchronized at the same frequency of 50 Hz. The pulse voltage applied to the Ge sputtering target was -1200 V and the pulse width was 80 usec. While operating the Ge sputtering gun in HiPIMS mode, a pulse bias of -50 kV was applied to the Si substrate. The pulse width was 50 usec with a 30 usec delay time with respect to the HiPIMS pulse. Ge ion implantation process was performed for 30 min. to achieve approximately 20 % of Ge concentration in Si substrate. Right after Ge ion implantation, ∼50 nm thick Si capping layer was deposited to prevent oxidation during subsequent RTA process at 1000°C in N2 environment. The Ge-implanted Si samples were analyzed using Auger electron spectroscopy, High-resolution X-ray diffractometer, Raman spectroscopy, and Transmission electron microscopy to investigate the depth distribution, the degree of strain relaxation, and the crystalline structure, respectively. The analysis results showed that a strain-relaxed SiGe layer of ∼100 nm thickness could be effectively formed on Si substrate by direct Ge ion implantation using the newly-developed PIII&D process for non-gaseous elements.

Keywords: Strain-relaxed SiGe, SiGe, Ion implantation, Non-gaseous plasma immersion ion implantation, HiPIMS