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Effect of Annealing under Antimony Ambient on Structural Recovery of Plasma-damaged InSb(100) Surface

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Due to the electrical properties such as narrow bandgap and high carrier mobility, indium antimonide (InSb) has attracted a lot of attention recently. For the fabrication of electronic or photonic devices, an etching process is required. However, during etching process, enegetic ions can induce structural damages on the bombarded surface. Especially, InSb has a very weak binding energy between In atom and Sb stom, it can be easily damaged by impingement of ions. In the previous work, to evaluate the surface properties after Ar ion beam etching, the plasma-induced structural damage on the etched InSb(100) surface had been examined by resonant Raman spectroscopy. As a result, we demonstrated the relation between the enhanced transverse optical(TO) peak in the Raman spectrum and the ion-induced structral damage near the InSb surface. In this work, the annealing effect on the etched InSb(100) surface has investigated. Annealing process was performed at 450^{o}C for 10 minute under antimony ambient. As-etched InSb(100) surface had shown a strongly enhanced TO scattering intensity in the Raman spectrum. However, the annealing process with antimony flowing caused the intensity to recover due to the structural reordering and the reduction of antimony vacancies. It proves that the origin of enhanced TO scattering is Sb vacancies. Furthermore, it shows that etching-induced damage can be cured effectively by the following annealing process under Sb ambient.

Keywords: Plasma etching, Surface damage, Raman spectroscopy, Compound semiconductor