[III~2] [초청]

Does sulfur-passivation of III-V compound semiconductors really work?

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From the view point of a surface scientist, the preparation of atomically clean III-V compound semiconductor surface is more than a pure interest. It might be true that the most popular semiconductor, Si, in the 20th century, can be replaced by III-V compound semiconductors, if there is a way to get over the anion-instability of compound semiconductors. Up to now preparation of useful III-V compound semiconductor surfaces depended upon the epitaxial growth techniques like molecular beam epitaxy (MBE), metal organic chemical vapor deposition (MOCVD), and liquid phase epitaxy (LPE). On the other hand, these techniques devoted themselves to the film growth related to the device application.

If the chemical etching of III-V compound semiconductor by $(NH_4)_2S_x$ in the air really works, it might easily produce the oxide-free, not-pinned (in the midgap), atomically flat, defect-free, and chemically inert interface.

In order to investigate these potential problems in sulfur passivation the photoemission techniques like x-ray photoelectron and synchrotron photoemission spectroscopies were employed. Especially, at the beam line 2B1 of Pohang Light Source, S-passivation of LPE grown InGaP was also studied. Using the tunable and high intensity photons of synchrotron radiation, the core level studies on this surface could be successfully conducted. For example the problematic core levels, In 4d and Ga 3d, with close binding energies and high photoionization cross sections, were clearly resolved by choosing the Cooper minimum energy of In 4d and the curve-fitting.

In the present studies we focussed on several points to clarify the S-passivation effects. Can sulfur-passivation be universally applied to any compound semiconductor surface? What is the function of sulfur element at the interface with violent chemical reactions? What is the relation between Fermi-level pinning and the gap states of sulfides? Can the ideal Schottky contact exist in the metal/S-passivated InGaP? On these questions, the results up to now will be presented.

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