총회초청 3

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Gas Source Molecular Beam Epitaxy of SiC

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Semiconducting silicon carbide (SiC) is now very attractive as a wide bandgap semiconductor which will take a big position in the next generation. Due to the limit in physical properties of the material, conventional semiconductors such as Si and GaAs have some limitation in the device operation. There are many application fields utilizing the fascinating properties of wide bandgap SiC such as high temperature, high frequency/high power and radiation resistant electronic devices.

Mostly SiC has been studied using homoepitaxially or heteroepitaxially grown layers by chemical vapor deposition (CVD). In the presentation, firstly the attractive points in semiconducting SiC is reviewed together with the present stage in crystal growth by CVD. Next, the important point of the crystal growth of SiC in a high vacuum is described. Gas-source molecular beam homoepitaxy of cubic SiC on cubic SiC(001) grown on Si by CVD is introduced, mainly the growth done by alternating supply of Si-related species and C-related species, so-called atomic-level control in epitaxial growth. Through detailed experiments on time evolution of the in-situ reflection high-energy electron diffraction (RHEED) of the cubic SiC surface, the change in surface reconstruction of cubic SiC(001) is analyzed, and a model of the surface superstructure is discussed. Then, heteroepitaxial growth of cubic SiC on Si in a high vacuum is studied through buffer layer formation (carbonization of Si surface by hydrocarbon supply) followed by SiC growth by supply of Si-related and C-related species. The effect of different hydrocarbon species on the carbonization process is described in detail. Pre-cracking of hydrocarbon gives special features in the carbonization process probably due to the formation of CH_3 radicals. Finally a future scope in the growth in a high vacuum will be proposed.