Formation of III-nitrides nano-heterostructures on patterned silicon substrate by selective epitaxy

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【 Outline of survey 】

The microstructures made by III-nitrides semiconductors have been expectedto open a new era in the quantum devices which will operate at hightemperatures. Because of the physical and chemical hardness of thematerials, however, the micro-fabrication technology is still to be studied. In this project, we will prepare micro- and nano-heterostructures on apatterned silicon substrate by adopting the selective epitaxy method. We will develop the new possibilities of a self-organized polyhedrons made of crystal facets. The subjects of the project will be; (1) How to improve/control the micro-/ nano-heteroepitaxy on crystal facets, (2) How will the surface chemical potential affect the formation/ activation of pointdefects to control the electrical/optical properties, (3) How to form a new quantum structure such as coupled dots to control the physical properties.The final goal of the project is to get profound understanding of thequantum system made by III-nitrides to propose a new opto-electronic device.

【 Expected results 】

We are to make a typical hetero-epitaxy to overcome the large latticemismatch. We are to reveal the physical phenomena on the formation of dislocations/point defects at the hetero-interfaces and the diffusionphenomena of chemical species on the crystal facets. The projects will givea new research field, both academic and technical, of nano-hetero-epitaxy,which will open a new quantum effect device system based on III-nitrides on silicon substrate.

【 References by the principal researcher 】

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2) " Growth of (1-101) GaN on a 7 degree off oriented (001)Si substrate by selective MOVPE," Y.Honda, N.Kameshiro, M.Yamaguchi and N.Sawaki, J. Crystal Growth 242, pp.82-86(2002)

【 Term of project 】 F Y 2004 — 2008

【 Budget allocation 】 89,200,000 yen

【 Homepage address 】 http://www.semicond.nuee.nagoya-u.ac.jp