Electrochemical Formation of Self-Assembled Nanopore Arrays As Templates for MBE Growth of InP-based Quantum Wires and Dots

Tetsuro Hirano, Akira Ito, Taketomo Sato, Fumitaro Ishikawa and Hideki Hasegawa

Research Center for Interface Quantum Electronics and Graduate School of Electronics and Information Engineering, Hokkaido University, North-13, West-8, Sapporo 060-8628, JAPAN
TEL: +81-11-706-7172, FAX: +81-11-716-6004, e-mail: hirano@rciqe.hokudai.ac.jp

Abstract

In this study, attempts were made to optimize the parameters of the electrochemical process to form uniform nanopore arrays in order to utilize them as templates for MBE growth of InP-based quantum wires and quantum dots. Template parameters such as the pore depth, diameter and period were strongly dependent on anodization conditions. Especially, in the pulsed anodization mode, the pore depth could be well controlled in the nanometer range by changing the number of the applied pulses. InGaAs MBE growth was attempted using the nanopore templates. Growth of InGaAs in pores took place into a substantial depth of about 100-200 nm. The measured PL spectrum had a new peak at about 1.2 eV in addition to the PL emission from the InP substrate and that of InGaAs top layer. The new peak was tentatively assigned to be from InGaAs quantum wire arrays embedded in InP pores with a possible alloy composition change.