Optical properties of the photonic crystals based on nano-crystalline-Si-dispersed films as an optically active medium

2002 Fiscal Year Final Research Report Summary

Optical properties of the photonic crystals based on nano-crystalline-Si-dispersed films as an optically active medium

Research Project

Project/Area Number

13650337

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

Electronic materials/Electric materials

Research Institution

Kanazawa University

Principal Investigator

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Project Period (FY)

2001 – 2002

Keywords

Si nanocrystal / Oxide matrix / Thin film / Multilayer / Photonic Crystal / Plasma CVD / Light-emitting Material

Research Abstract

Nanocrystalline (nc-) Si-dispersed films, which are the silicon oxide thin films including nc-Si dispersively, are a new light-emitting material providing high efficiency visible photolminescence (PL). Previously, we have demonstrated that broad PL band width in the nc-Si-dispersed films can be narrowed effectively using a virtical optical cavity. In this project, we aimed to achieve a higher-order control of the light emission spectra of the nc-Si-dispersed films utilizing a two dimensional (2D) photonic crystal. The 2D photonic crystal structure was formed using an electron-beam lithography system. A triangular lattice with a lattice constant of 400 nm and 350 nm have been formed. The anisotropic etching of the nc-Si-dispersed films was achieved by using a CF_4-H_2 plasma of an appropriate feed gas ratio. It was confirmed that the

propagation of emitted light along the layer was sufficiently suppressed by the 2D photonic crystal structure. On the other hand, the effect of the 2D photonic crystal structure on the spectra and intensity of the emmited light was not clear.

Research Products (4 results)

All Other

All Publications

[Publications] A.M.Ali: "Structural and Optical Properties of Nanocrystalline Silicon Films Deposited Plasma-Enhanced Chemical Vapor Deposition"Japanese Journal of Applied Physics. 41・1. 169-175 (2002)

[Publications] Takao Inokuma: "Controlled Photoluminescence from Silicon Nanocrystals in a Vertical Optical Cavity with Distributed Bragg Reflectors"Physica Status Solidi(b). (発表予定).

[Publications] Atif Mossad Ali, Takao Inokuma, Yoshihiro Kurata and Seiichi Hasegawa: "Structural and Optical Properties of Nanocrystalline Silicon Films Deposited by Plasma-Enhanced Chemical Vapor Deposition"Japanese Journal of Applied Physics. Vol. 41, Pt. 1, No. 1. 168-175

[Publications] Takao Inokuma, Yoshihiro Kurata and Seiichi Hasegawa: "Controlled Photoluminescence from Silicon Nanocrystals in a Vertical Optical Cavity with Distributed Bragg Reflectors"Phisica Status Solidi. (in press).

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