The response of temperature and hydrostatic pressure of zinc-blende GaxIn1-x As semiconducting alloys

Author(s): Degheidy, AR (Degheidy, A. R.)[1] ; Elkenany, EB (Elkenany, E. B.)[1]
[1] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: kena@mans.edu.eg

Abstract

The electronic band structure of GaxIn1-x As alloy is calculated by using the local empirical pseudo-potential method including the effective disorder potential in the virtual crystal approximation. The compositional effect of the electronic energy band structure of this alloy is studied with composition x ranging from 0 to 1. Various physical quantities such as band gaps, bowing parameters, refractive indices, and high frequency dielectric constants of the considered alloys with different Ga concentrations are calculated. The effects of both temperature and hydrostatic pressure on the calculated quantities are studied. The obtained results are found to be in good agreement with the available experimental and published data.

Accession Number: WOS:000314221400050

Document Type: Article

Language: English

Author Keywords: temperature; hydrostatic pressure to GaxIn1-x As alloys

KeyWords Plus: ENERGY-GAP; REFRACTIVE-INDEX; BAND-STRUCTURE; ELECTRONIC-PROPERTIES; GA1-XALXAS ALLOYS; GAAS; DEPENDENCE; MOLECULES; INAS; INSB

Reprint Address: Elkenany, EB (reprint author)
Mansoura Univ, Fac Sci, Dept Phys, POB 35516, Mansoura, Egypt.

Source: CHINESE PHYSICS B Volume: 21 Issue: 12 Article Number: 126101 DOI: 10.1088/1674-1056/21/12/126101 Published: DEC 2012

Publisher: IOP PUBLISHING LTD, TEMPLE CIRCUS, TEMPLE WAY, BRISTOL BS1 6BE, ENGLAND

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 080DM

ISSN: 1674-1056

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Albedo problem in a semi-infinite medium with pure-triplet scattering

Author(s): Degheidy, AR (Degheidy, A. R.)[2] ; El-Depsy, A (El-Depsy, A.)[1] ; Gharbiea, DA (Gharbiea, D. A.)[1] ; Sallah, M (Sallah, M.)[2]
[1] Mansoura Univ, Fac Sci Damietta, Dept Phys, Mansoura, Egypt

[2] Mansoura Univ, Fac Sci Mansoura, Dept Phys, Mansoura, Egypt

E-mail Addresses: dalia_az1@hotmail.com

Abstract

Particle transport problem in an absorbing, scattering and homogeneous semi-infinite medium with pure-triplet scattering is considered. The medium is subjected to externally incident radiation. The problem is solved by using an efficient and accurate method of analysis which utilizes trial functions based on Case's eigenmodes plus a linear combination of exponential functions. This trial function is used in the integral form of the transport equations, which transfer it to a system of algebraic equations in unknown expansion coefficients. The expansion coefficients are used to calculate some physical quantities as the albedo and the net flux at the boundary of the medium. Numerical results are reported and compared with that calculated by another trial functions.

Accession Number: WOS:000311514300011

Document Type: Article

Language: English

Author Keywords: Radiative transfer; Albedo problem; Semi-infinite; Triplet scattering

KeyWords Plus: ANISOTROPIC SCATTERING; REFLECTING BOUNDARY; ATMOSPHERE; TRANSPORT

Reprint Address: Gharbiea, DA (reprint author)

Mansoura Univ, Fac Sci Damietta, Dept Phys, Mansoura, Egypt.
Source: INDIAN JOURNAL OF PHYSICS Volume: 86 Issue: 12 Pages: 1131-1137 DOI: 10.1007/s12648-012-0145-8 Published: DEC 2012

Publisher: INDIAN ASSOC CULTIVATION SCIENCE, INDIAN J PHYSICS, JADAVPUR, KOLKATA 700 032, INDIA

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 043AI

ISSN: 0973-1458

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Temperature and hydrostatic pressure dependence of the electronic structure of AlxGa1-xAs alloys

Author(s): Degheidy, AR (Degheidy, Abdel Razik)[1] ; Elkenany, EB (Elkenany, Elkenany Brens)[1]
[1] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: kena@mans.edu.eg

Abstract

The study of the electronic band structure of AlxGa1-xAs alloy is calculated within the local empirical pseudo-potential method including the effective disorder potential into the virtual crystal approximation. Monotonic decreasing and increasing functions are obtained for the temperature and pressure dependent form factors, respectively. Some physical quantities as band gaps, bowing parameters, refractive indices, and dielectric constants of the considered alloy with different Al concentration are calculated under the effects of temperature and hydrostatic pressure. The obtained results have been found in good agreement with the experimental and published data.

Accession Number: WOS:000307142500008

Document Type: Article

Language: English

Author Keywords: Temperature and pressure; Electronic structure; Compositional disorders

KeyWords Plus: DIRECT-ENERGY-GAP; BAND-STRUCTURE; REFRACTIVE-INDEX; COMPOUND SEMICONDUCTORS; AL CONCENTRATION; GAAS; MOLECULES

Reprint Address: Elkenany, EB (reprint author)
Mansoura Univ, Fac Sci, Dept Phys, POB 35516, Mansoura, Egypt.

Source: MATERIALS SCIENCE IN SEMICONDUCTOR PROCESSING Volume: 15 Issue: 5 Pages: 505-515 DOI: 10.1016/j.mssp.2012.03.014 Published: OCT 2012

Publisher: ELSEVIER SCI LTD, THE BOULEVARD, LANGFORD LANE, KIDLINGTON, OXFORD OX5 1GB, OXON, ENGLAND

Web of Science Categories: Engineering, Electrical & Electronic; Materials Science, Multidisciplinary; Physics, Applied; Physics, Condensed Matter

Research Areas: Engineering; Materials Science; Physics

IDS Number: 983TV

ISSN: 1369-8001

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Optoelectronic properties of GaAs1-xPx alloys under the influence of temperature and pressure

Author(s): Degheidy, AR (Degheidy, Abdel Razik)[1] ; Elabsy, AS (Elabsy, Abdel Salam)[1] ; Elkenany, EB (Elkenany, Elkenany Brens)[1]
[1] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: kena@mans.edu.eg

Abstract

This work is concerned with the dependence of the electronic energy band structures for GaAs1-xPx alloys on temperature and pressure that is based on local empirical pseudo-potential method. The band structures of GaAs1-xPx alloys were calculated in the virtual crystal approximation using the EPM which incorporates compositional disorder as an effective potential.

It was found that temperature and pressure dramatically change the crossover energies, refractive index and dielectric constant of the alloys.

The calculated energy band gaps, bowing parameters, refractive indices, and dielectric constants of GaAs1-xPx alloys with different phosphide concentrations are found in close agreement with the published data.

Therefore it can be stated that the temperature and pressure are highly significant when studying and operating devices based on GaAs1-xPx alloys.

Accession Number: WOS:000306727200020

Document Type: Article

Language: English

Author Keywords: Optoelectronic properties; GaAs1-xPx; Temperature; Pressure

KeyWords Plus: ENERGY-GAP; REFRACTIVE-INDEX; COMPOUND SEMICONDUCTORS; DEPENDENCE; CONSTANTS; GAAS

Reprint Address: Elkenany, EB (reprint author)

Mansoura Univ, Fac Sci, Dept Phys, POB 35516, Mansoura, Egypt.

Source: SUPERLATTICES AND MICROSTRUCTURES Volume: 52 Issue: 2 Pages: 336-348 DOI: 10.1016/j.spmi.2012.04.019 Published: AUG 2012

Publisher: ACADEMIC PRESS LTD- ELSEVIER SCIENCE LTD, 24-28 OVAL RD, LONDON NW1 7DX, ENGLAND

Web of Science Categories: Physics, Condensed Matter

Research Areas: Physics

IDS Number: 978FY

ISSN: 0749-6036

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Inventor/Assignee: Masatake, W.; Tsuneyuki, K.; Masayuki, S.; et al.
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Author(s): WELBER, B; CARDONA, M; KIM, CK; et al.
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Pressure dependence of the electronic structure in Ge, GaP and InP semiconductors at room temperature

Author(s): Degheidy, AR (Degheidy, A. R.)[1] ; Elabsy, AM (Elabsy, A. M.)[1] ; Abdelwahed, HG (Abdelwahed, H. G.)[1] ; Elkenany, EB (Elkenany, E. B.)[1]

[1] Mansoura Univ, Fac Sci, Dept Phys, Mansoura, Egypt

E-mail Addresses: kena@mans.edu.eg

Abstract

The electronic structure of Ge, GaP and InP semiconductors under hydrostatic pressure based on the empirical pseudopotential method have been reported. The pressure coefficients, pressure dependent form factors, of the main band gaps at and symmetry points in the Brillouin zone have been calculated. We have found that most of the values of the electronic energy bands were more sensitive to the pressure dependent form factors associated with the reciprocal lattice vectors of than any other value. Our calculations for the energy gaps of the semiconductors under investigation at different pressures have been found to be in excellent agreement with available experimental data.

Accession Number: WOS:000305517400007

Document Type: Article

Language: English

Author Keywords: Pressure; Electronic structure; Semiconductors

KeyWords Plus: HYDROSTATIC-PRESSURE; STABILITY; MOLECULES; ENERGY; GAAS; ALAS

Reprint Address: Elkenany, EB (reprint author)

Mansoura Univ, Fac Sci, Dept Phys, POB 35516, Mansoura, Egypt.

Source: INDIAN JOURNAL OF PHYSICS Volume: 86 Issue: 5 Pages: 363-369 DOI: 10.1007/s12648-012-0059-5 Published: MAY 2012

Publisher: INDIAN ASSOC CULTIVATION SCIENCE, INDIAN J PHYSICS, JADAVPUR, KOLKATA 700 032, INDIA

Web of Science Categories: Physics, Multidisciplinary

Research Areas: Physics

IDS Number: 962CQ

ISSN: 0973-1458

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