

J. Appl. Phys. **104**, 093507 (2008); <http://dx.doi.org/10.1063/1.2986159> (5 pages)

Analysis of the optical properties of $\text{Cu}(\text{In}_{1-x}\text{Ga}_x)_3\text{Se}_5$ crystals

 M. León¹, R. Serna², S. Levchenko³, G. Gurieva³, J. M. Merino¹, E. J. Friedrich¹, and E. Arushanov^{1,3}
¹Departamento Física Aplicada, Universidad Autónoma de Madrid, C-XII, 28049 Madrid, Spain

²Laser Processing Group, Instituto de Óptica, CSIC, Serrano 121, 28006 Madrid, Spain

³Institute of Applied Physics, Academy of Sciences of Moldova, Chisinau MD 2028, Moldova

[View Map](#)

(Received 12 June 2008; accepted 29 July 2008; published online 5 November 2008)

Analysis of the optical properties of bulk $\text{Cu}(\text{In}_{1-x}\text{Ga}_x)_3\text{Se}_5$ mixed crystals synthesized from the elements as a function of the Ga content is presented. Measurements of the complex dielectric function $\epsilon(\omega) = \epsilon_1(\omega) + i\epsilon_2(\omega)$ were performed at room temperature in the photon energy range of 0.8–4.7 eV using a variable angle of incidence ellipsometer. The spectral dependence of the complex refractive index, the absorption coefficient, and the normal-incidence reflectivity were also derived. The structure observed in the dielectric functions attributed to the interband transitions E_0 , E_{1A} , and E_{1B} has been modeled using a modification of the Adachi's model. The results are in excellent agreement with the experimental data over the entire range of photon energies. The model parameters, including the energies corresponding to the lowest direct gap and higher critical points, have been determined using the simulated annealing algorithm. The values of E_0 and E_{1A} are found to increase linearly with the increasing Ga content.

© 2008 American Institute of Physics

Article Outline

- I. INTRODUCTION
- II. EXPERIMENTAL METHODS AND ANALYSIS METHODOLOGY
- III. RESULTS AND DISCUSSIONS
- IV. CONCLUSIONS

LOG IN or SELECT A PURCHASE OPTION:

- Buy PDF
- Rent Article (save 93%)
- Permissions / Reprints
- Log In to Read Online (HTML)
- Login to Download PDF

Alerts Tools Share

RELATED DATABASES

To view database links for this article, you need to log in.

KEYWORDS and PACS

Keywords

absorption coefficients, copper compounds, dielectric function, gallium compounds, indium compounds, refractive index, simulated annealing, ternary semiconductors

PACS

78.20.Ci

Optical constants (including refractive index, complex dielectric constant, absorption, reflection and transmission coefficients, emissivity)

ARTICLE DATA

Digital Object Identifier

<http://dx.doi.org/10.1063/1.2986159>

PUBLICATION DATA

ISSN

 0021-8979 (print)
1089-7550 (online)

Publisher

American Institute of Physics



For access to fully linked references, you need to log in.

 Selected: [Export Citations](#) | [Add to MyArticles](#)
[View in Separate Window/Tab](#)

References

- D. Schmid, M. Ruckh, F. Granwald, and H. W. Schock, *J. Appl. Phys.* **73**, 2902 (1993)
- L. Stolt, J. Hedstrom, J. Kessler, M. Puch, K. O. Velthaus, and H. W. Schock, *Appl. Phys. Lett.* **62**, 597 (1993).
- H. Z. Xiao, L. Yang Chung, and A. Rockett, *J. Appl. Phys.* **76**, 1503 (1994).
- T. Negami, N. Kohara, M. Nishitani, T. Wada, and T. Hirao, *Appl. Phys. Lett.* **67**, 825 (1995).
- M. León, R. Serna, S. Levchenko, A. Nateprov, A. Nicorici, J. M. Merino, and E. Arushanov, *J. Appl. Phys.* **101**, 013524 (2007).
- M. León, R. Serna, S. Levchenko, A. Nicorici, J. M. Merino, E. J. Friedrich, and E. Arushanov, *J. Appl. Phys.* **103**, 103503 (2008).
- M. I. Alonso, M. Garrida, C. A. Durante Rincon, and M. Leon, *J. Appl. Phys.* **88**, 5796 (2000)
- J. G. Albornoz, R. Serna, and M. León, *ibid.* **97**, 103515 (2005).
- H. Y. Deng and N. Dai, *Phys. Rev. B* **73**, 113102 (2006).
- T. Kawashima, S. Adachi, H. Miyake, and K. Sugiyama, *J. Appl. Phys.* **84**, 5202 (1998).
- T. Kawashima, H. Yoshikawa, S. Adachi, S. Fuke, and K. Ohtsuka, *J. Appl. Phys.* **82**, 3528 (1997).



ADVERTISEMENT



Ground loops
hard to find?
Find them fast
with the
Loop Slooth
without
disconnecting
anything!

Most Cited Research

Read the month's most cited journal papers.

A. B. Djuric and E. Herbert Li, *J. Appl. Phys.* **85**, 2848 (1999).

J. E. Jaffe and A. Zunger, *Phys. Rev. B* **28**, 5822 (1983).

M. I. Alonso, K. Wakita, J. Pascual, M. Garriga, and N. Yamamoto, *Phys. Rev. B* **63**, 075203 (2001).

For access to citing articles, you need to [log in](#).

Figures (7) Tables (2)

Access to article objects (figures, tables, multimedia) requires a subscription; [log in](#) to view available files. (Access to supplementary files, where available, is free for this journal.)

[Related Articles](#) | [Related Patents](#)

Related Articles



[View More](#)

Your Recent History

Recently Viewed

- Analysis of the optical properties of $\text{Cu}(\text{In}_{1-x}\text{Ga}_x)_3\text{Se}_5$ crystals
- Nanocrystal characterization by ellipsometry in porous silicon using model dielectric function
- Optical constants of $\text{Cu}(\text{In}_{1-x}\text{Ga}_x)_5\text{Se}_8$ crystals
- Optical constants of $\text{Cu}_2\text{ZnGeS}_4$ bulk crystals



© 2013 AIP Publishing LLC

